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Pesticide Registraion Standard
S-Methyl N- (Methylcarbamoyl)
Oxy-Thioacetimidate (Methomyl)

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Pesticides

Methomyl

S-methyl N-[(methylcarbamoyl)oxy]-thioacetimidate

Pesticide Registration Standard

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METHOMYL

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CHAPTER I: HOW TO REGISTER UNDER A REGISTRATION STANDARD

A. Organization of the Standard
B. Purpose of the Standard
C. Requirement to Reregister Under the Standard
D. "Product Specific" Data and "Generic" Data
E. Data Compensation Requirements under FIFRA 3(c)(1)(D)
F. Obtaining Data to Fill " Data Gaps"; FIFRA 3(c)(2)(B)
G. Amendments to the Standard

A. Organization of the Standard

This first chapter explains the purpose of a Registration Standard and summarizes the legal principles involved in registering or reregistering under a Standard. The second chapter sets forth the requirements that must be met to obtain or retain registration for products covered by this particular Registration Standard. In the remaining chapters, the Agency reviews the available data by scientific discipline, discusses the Agency's concerns with the identified potential hazards, and logically develops the conditions and requirements that would reduce those hazards to acceptable levels.

B. Purpose of the Standard

Section 3 of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) provides that "no person in any State may distribute, sell, offer for sale, hold for sale, ship, deliver for shipment, or receive (and having so received) deliver or offer to deliver, to any person any pesticide which is not registered with the Administrator [of EPA]." To approve the registration of a pesticide, the Administrator must find, pursuant to Section 3(c)(5) that:

"(A) its composition is such as to warrant the proposed claims for it;

(B) its labeling and other material required to be submitted comply with the requirements of this Act;

(C) it will perform its intended function without unreasonable adverse effects on the environment; and

(D) when used in accordance with widespread and commonly recognized practice it will not generally cause unreasonable adverse effects on the environment."

In making these findings, the Agency reviews a wide range of data which registrants are required to submit, and assesses the risks and benefits associated with the use of the proposed pesticide. But the established approach to making these findings has been found to be defective on two counts:

First, EPA and its predecessor agency, the United States Department of Agriculture (USDA), routinely reviewed registration applications on a "product by product" basis, evaluating each product-specific application somewhat independently. In the review of products containing similar components, there was little opportunity for a retrospective review of the full range of pertinent data available in Agency files and in the public literature. Thus the "product by product" approach was often inefficient and sometimes resulted in inconsistent or incomplete regulatory judgments.

Second, over the years, as a result of inevitable and continuing advances in scientific knowledge, methodology, and policy, the data base for many pesticides came to be considered inadequate by current scientific and regulatory standards. Given the long history of pesticide regulation in several agencies, it is even likely that materials may have been lost from the data files. When EPA issued new requirements for registration in 1975 (40 CFR 162) and proposed new guidelines for hazard testing in 1978 (43 FR 29686, July 10, 1978 and 43 FR 37336, August 2, 1978), many products that had already been registered for years were being sold and used without the same assurances of human and environmental safety as was being required for new products. Because of this inconsistency, Congress directed EPA to re-register all previously registered products, so as to bring their registrations and their data bases into compliance with current requirements, [See FIFRA Section 3(g)].

Facing the enormous job of re-reviewing and calling-in new data for the approximately 35,000 current registrations, and realizing the inefficiencies of the "product by product" approach, the Agency decided that a new, more effective method of review was needed.

A new review procedure has been developed. Under it, EPA publishes documents called Registration Standards, each of which discusses a particular pesticide active ingredient. Each Registration Standard summarizes all the data available to the Agency on a particular active ingredient and its current uses, and sets forth the Agency's comprehensive position on the conditions and requirements for registration of all existing and future products which contain that active ingredient. These conditions and requirements, all of which must be met to obtain or retain full registration or reregistration under Section 3(c)(5) of FIFRA, include the submission of needed scientific data which the Agency does not now have, compliance with standards of toxicity, composition, labeling, and packaging, and satisfaction of the data compensation provisions of FIFRA Section 3(c)(1)(D).

The Standard will also serve as a tool for product classification. As part of the registration of a pesticide product, EPA may classify each product for "general use" or "restricted use" [FIFRA Section 3(d)]. A pesticide is classified for "restricted use" when some special regulatory restriction is needed to ensure against unreasonable adverse effects to man or the environment. Many such risks of unreasonable adverse effects can be lessened if expressly-designed label precautions are strictly followed. Thus the special regulatory restriction for a "restricted use" pesticide is usually a requirement that it be applied only by, or under the supervision of, an applicator who has been certified by the State or Federal government as being competent to use pesticide safely, responsibly, and in accordance with label directions. A restricted-use pesticide can have other regulatory restrictions [40 CFR 162.11(c)(5)] instead of, or in addition to, the certified applicator requirement. These other regulatory restrictions may include such actions as seasonal or regional limitations on use, or a requirement for the monitoring of residue levels after use. A pesticide classified for "general use," or not classified at all, is available for use by any individual who is in compliance with State or local regulations. The Registration Standard review compares information about potential adverse effects of specific uses of the pesticide with risk criteria listed in 40 CFR 162.11(c), and thereby determines whether a product needs to be classified for "restricted use." If the Standard does classify a pesticide for "restricted use," this determination is stated in the second chapter.

C. Requirement to Reregister Under the Standard

FIFRA Section 3(g), as amended in 1978, directs EPA to reregister all currently registered products as expeditiously as possible. Congress also agreed that reregistration should be accomplished by the use of Registration Standards.

Each registrant of a currently registered product to which this Standard applies, and who wishes to continue to sell or distribute his product in commerce, must apply for reregistration. His application must contain proposed labeling that complies with this Standard.

EPA will issue a notice of intent to cancel the registration of any currently registered product to which this Standard applies if the registrant fails to comply with the procedures for reregistration set forth in the Guidance Package which accompanies this Standard.

D. "Product Specific" Data and "Generic" Data

In the course of developing this Standard, EPA has determined the types of data needed for evaluation of the properties and effects of products to which the Standard applies, in the disciplinary areas of Product Chemistry, Environmental Fate, Toxicology, Residue Chemistry, and Ecological Effects. These determinations are based primarily on the data Guidelines proposed in 43 FR 29696, July 10, 1978; 43 FR 37336, August 22, 1978; and 45 FR 72948, November 3, 1980, as applied to the use patterns of the products to which this Standard applies. Where it appeared that data from a normally applicable Guidelines requirement was actually unnecessary to evaluate these products, the Standard indicates that the requirement has been waived. On the other hand, in some cases studies not required by the Guidelines may be needed because of the particular composition or use pattern of products the Standard covers; if so, the Standard explains the Agency's reasoning. Data guidelines have not yet been proposed for the Residue Chemistry discipline, but the requirements for such data have been in effect for some time and are, the Agency believes, relatively familiar to registrants. Data which we have found are needed to evaluate the registrability of some products covered by the Standard may not be needed for the evaluation of other products, depending upon the composition, formulation type, and intended uses of the product in question. The Standard states which data requirements apply to which product categories. (See the third chapter.) The various kinds of data normally required for registration of a pesticide product can be divided into two basic groups:

1. Data that are product specific , i.e. data that relates only to the the properties or effects of a product with a particular composition (or a group of products with closely similar composition); and

2. Generic data that pertains to the properties or effects of a particular ingredient, and thus is relevant to an evaluation of the risks and benefits of all products containing that ingredient (or all such products having a certain use pattern), regardless of any such product's unique composition.

The Agency requires certain "product specific" data for each product to characterize the product's particular composition and physical/chemical properties (Product Chemistry), and to characterize the product's acute toxicity (which is a function of its total composition). The applicant for registration or reregistration of any product, whether it is a manufacturing-use or end-use product, and without regard to its intended use pattern, must submit or cite enough of this kind of data to allow EPA to evaluate the product. For such purposes, "product specific" data on any product other than the applicant's is irrelevant, unless the other product is closely similar in composition to the applicant's. (Where it has been found practicable to group similar products for purposes of evaluating, with a single set of tests, all products in the group, the Standard so indicates.) "Product specific" data on the efficacy of particular end-use products is also required where the exact formulation may affect efficacy and where failure of efficacy could cause public health problems.

All other data needed to evaluate pesticide products concerns the properties or effects of a particular ingredient of products (normally a pesticidally active ingredient, but in some cases a pesticidally inactive, or "inert", ingredient). Some data in this "generic" category are required to evaluate the properties and effects of all products containing that ingredient [e.g., the acute LD-50 of the active ingredient in its technical or purer grade; see proposed 40 CFR 163.81-1(a), 43 FR 37355].

Other "generic" data are required to evaluate all products which both contain a particular ingredient and are intended for certain uses (see, e.g., proposed 40 CFR 163.82-1, 43 FR 37363, which requires subchronic oral testing of the active ingredient with respect to certain use patterns only). Where a particular data requirement is use-pattern dependent, it will apply to each end-use product which is to be labeled for that use pattern (except where such end-use product is formulated from a registered manufacturing-use product permitting such formulations) and to each manufacturing-use product with labeling that allows it to be used to make end-use products with that use pattern. Thus, for example, a subchronic oral dosing study is needed to evaluate the safety of any manufacturing-use product that legally could be used to make an end-use, food-crop pesticide. But if an end-use product's label specified it was for use only in ways that involved no food/feed exposure and no repeated human exposure, the subchronic oral dosing study would not be required to evaluate the product's safety; and if a manufacturing-use product's label states that the product is for use only in making end-use products not involving food/feed use or repeated human exposure, that subchronic oral study would not be relevant to the evaluation of the manufacturing-use product either.

If a registrant of a currently registered manufacturing-use or end-use product wishes to avoid the costs of data compensation [under FIFRA Section 3(c)(1)(D)] or data generation [under Section 3(c)(2)(B)] for "generic" data that is required only with respect to some use patterns, he may elect to delete those use patterns from his labeling at the time he reregisters his product. An applicant for registration of a new product under this Standard may similarly request approval for only certain use patterns.

E. Data Compensation Requirements under FIFRA 3(c)(1)(D)

Under FIFRA Section 3(c)(1)(D), an applicant for registration, reregistration, or amended registration must offer to pay compensation for certain existing data the Agency has used in developing the Registration Standard. The data for which compensation must be offered is all data which are described by all the following criteria:

1. The data were first submitted to EPA (or to its predecessor agencies, USDA or FDA), on or after January 1, 1970;

2. The data were submitted to EPA (or USDA or FDA) by some other applicant or registrant in support of an application for an experimental use permit, an amendment adding a new use to a registration, or for registration, or to support or maintain in effect an existing registration;

3. They are the kind of data which are relevant to the Agency's decision to register or reregister the applicant's product under the Registration Standard, taking into account the applicant's product's composition and intended use pattern(s);

4. The Agency has found the data to be valid and usable in reaching regulatory conclusions; and

5. They are not data for which the applicant has been exempted by FIFRA Section 3(c)(2)(D) from the duty to offer to pay compensation. (This exemption applies to the "generic" data concerning the safety of an active ingredient of the applicant's product, not to "product specific" data. The exemption is available only to applicants whose product is labeled for end-uses for which the active ingredient in question is present in the applicant's product because of his use of another registered product containing that active ingredient which he purchases from another producer.)

An applicant for reregistration of an already registered product under this Standard, or for registration of a new product under this Standard, accordingly must determine which of the data used by EPA in developing the Standard must be the subject of an offer to pay compensation, and must submit with his application the appropriate statements evidencing his compliance with FIFRA Section 3(c)(1)(D).

An applicant would never be required to offer to pay for "product specific" data submitted by another firm. In many, if not in most cases, data which is specific to another firm's product will not suffice to allow EPA to evaluate the applicant's product, that is, will not be useful to the Agency in determining whether the applicant's product is registrable. There may be cases, however, where because of close similarities between the composition of two or more products, another firm's data may suffice to allow EPA to evaluate some or all of the "product specific" aspects of the applicant's product. In such a case, the applicant may choose to cite that data instead of submitting data from tests on his own product, and if he chooses that option, he would have to comply with the offer-to-pay requirements of Section 3(C)(1)(D) for that data.

Each applicant for registration or reregistration of a manufacturing-use product, and each applicant for registration or reregistration of an end-use product, who is not exempted by FIFRA Section 3(c)(2)(D), must comply with the Section 3(c)(1)(D) requirements with respect to each item of "generic" data that relates to his product's intended uses.

A detailed description of the procedures an applicant must follow in applying for reregistration (or new registration) under this Standard is found in the

Guidance Package for this Standard.

F. Obtaining Data to Fill "Data Gaps"; FIFRA 3(c)(2)(B)

Some of the kinds of data EPA needs for its evaluation of the properties and effects of products to which this Standard applies have never been submitted to the Agency (or, if submitted, have been found to have deficiencies rendering them inadequate for making registrability decisions) and have not been located in the published literature search that EPA conducted as part of preparing this Standard. Such instances of missing but required data are referred to in the Standard as "data gaps".

FIFRA Section 3(c)(2)(B), added to FIFRA by the Congress in 1978, authorizes EPA to require registrants to whom a data requirement applies to generate (or otherwise produce) data to fill such "gaps" and submit those data to EPA. EPA must allow a reasonably sufficient period for this to be accomplished. If a registrant fails to take appropriate and timely steps to fill the data gaps identified by a section 3(c)(2)(B) order, his product's registration may be suspended until the data is submitted. A mechanism is provided whereby two or more registrants may agree to share in the costs of producing data for which they are both responsible.

The Standard lists, in the third chapter, the "generic" data gaps and notes the classes of products to which these data gaps pertain. The Standard also points out that to be registrable under the Standard, a product must be supported by certain required "product specific" data. In some cases, the Agency may possess sufficient "product specific" data on one currently registered product, but may lack such data on another. Only those Standards which apply to a very small number of currently registered products will attempt to state definitively the " product specific" data gaps on a "product by product" basis. (Although the Standard will in some cases note which data that EPA does possess would suffice to satisfy certain "product specific" data requirements for a category of products with closely similar composition characteristics.)

As part of the process of reregistering currently registered products, EPA will issue Section 3(c)(2)(B) directives requiring the registrants to take appropriate steps to fill all identified data gaps — whether the data in question are "product specific" or "generic" — in accordance with a schedule.

Persons who wish to obtain registrations for new products under this Standard will be required to submit (or cite) sufficient "product specific" data before their applications are approved. Upon registration, they will be required under Section 3(c)(2)(B) to take appropriate steps to submit data needed to fill "generic" data gaps. (We expect they will respond to this requirement by entering into cost-sharing agreements with other registrants who previously have been told they must furnish the data.) The Guidance Package for this Standard details the steps that must be taken by registrants to comply with Section 3(c)(2)(B).

Registrants are reminded that Section 6(a)(2) of FIFRA requires you at any time to submit factual information raising concerns of possible unreasonable adverse effects of a pesticide. You should notify the Agency of interim results of studies in progress if those results show possible adverse effects.

G. Amendments to the Standard

Applications for registration which propose uses or formulations that are not presently covered by the Standard, or which present product compositions, product chemistry data, hazard data, toxicity levels, or labeling that do not meet the requirements of the Standard, will automatically be considered by the Agency to be requests for amendments to the Standard. In response to such applications, the Agency may request additional data to support the proposed amendment to the Standard, or may deny the application for registration on the grounds that the proposed product would cause unreasonable adverse effects to the environment. In the former case, when additional data have been satisfactorily supplied, and providing that the data do not indicate the potential for unreasonable adverse effects, the Agency will then amend the Standard to cover the new registration.

Each Registration Standard is based upon all data and information available to the Agency's reviewers on a particular date prior to the publication date. This "cut-off" date is stated at the beginning of the second chapter. Any subsequent data submissions and any approved amendments will be incorporated into the Registration Standard by means of addenda, which are available for inspection at EPA in Washington, D.C., or copies of which may be requested from the Agency. When all the present "data gaps" have been filled and the submitted data have been reviewed, the Agency will revise the Registration Standard. Thereafter, when the Agency determines that the internally maintained addenda have significantly altered the conditions for registration under the Standard, the document will be updated and re-issued.

While the Registration Standard discusses only the uses and hazards of products containing the designated active ingredient(s), the Agency is also concerned with the potential hazards of some inert ingredients and impurities. Independent of the development of any one Standard, the Agency has initiated the evaluation of some inert pesticide ingredients. Where the Agency has identified inert ingredients of concern in a specific product to which the Standard applies, these ingredients will be pointed out in the Guidance Package.

CHAPTER II

AGENCY POSITION ON METHOMYL

Introduction

This chapter describes in detail the Agency's regulatory position on products which contain methomyl as the sole active ingredient. The regulatory position adopted by the Agency incorporates a number of considerations. Foremost among these considerations is an analysis of the possible registration of products containing methomyl based on the risk criteria found in Section 162.11(a) of Title 40 of the U.S. Code of Federal Regulations. The Agency's determination is presented below, and the rationale for this basic decision follows the position.

In addition to this decision and rationale, this chapter includes the following: criteria for the registration of methomyl products under the Standard; acceptable ranges and limits for product composition, acute toxicity, and use pattern/application method; required labeling; tolerance reassessment.

The scientific basis for a decision presented in this chapter can be found by reading the various disciplinary chapters (Chapters IV-IX) which provide summaries of available scientific data on methomyl. The data requirements and data gaps are presented in Chapter III, Tables 1-3. Also, the reason for establishing a data requirement can be found in the footnotes of the tables in Chapter III and also in the topical discussions portion of Chapters IV-IX. References to Agency guidelines for testing are provided when appropriate. In instances where the data requirements differ from the guideline requirements, the rationale is presented in the footnotes of the tables.

Description of Chemical

Methomyl is a carbamate insecticide used to control a broad spectrum of insect pests in agricultural and ornamental crops. Approximately 70-80 percent of the methomyl purchased annually in the United States is used on soybeans, peanuts, cotton, and tobacco. Technical methomyl is a white, crystalline solid with a slight sulfurous odor. There are four currently registered manufacturing-use products of which there are two technical methomyl products (98% and 95% methomyl) and two are formulation intermediate products (90% and 26% methomyl). Methomyl formulations include both solid and liquid soluble concentrates, granulars (including baits), and dusts.

Methomyl is the common name for S-methyl N-[(methylcarbamoyl)oxy]-thioacetimidate. Methomyl is marketed under the trade names of Lannate^R and Nudrin^R. The Chemical Abstracts Registry (CAS) number for methomyl is 16752-77-5 and the EPA Shaughnessy number is 090301.

Regulatory Position for Products Containing Methomyl

Methomyl, S-methyl N-[(methylcarbamoyl)oxy]thioacetimidate, as described in this Standard may be registered for sale, distribution, reformulation, and use in the United States. Considering all information available to the Agency from the open literature and provided to the Agency as of January 30, 1980 and all data submitted to the Agency by registrants, as of January 30, 1980, the Agency

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finds that none of the risk criteria found in Section 162.11(a) of Title 40 of the U.S. Code of Federal Regulations were met or exceeded for pesticide products containing methomyl.

Available data indicate that the use of methomyl will not result in unreasonable adverse effects to man or the environment. Currently registered methomyl products may be reregistered subject to the conditions imposed. New products and new uses may be registered under this Standard and are subject to the same requirements.

Three methomyl formulations are presently classified as restricted use pesticides: concentrated solution formulations, 90% soluble concentrate formulations not in water soluble bags, and 1-5% baits (excluding the 1% fly bait). These formulations can only be applied by or under the direct supervision of certified applicators (see page 2-4 for further explanation of the restriction).

Regulatory Rationale for Methomyl

Methomyl is a carbamate insecticide used on a wide variety of food crops to control a broad spectrum of insect pests. The Agency has conducted a thorough review of available data on the safety of methomyl and has identified a number of potential concerns.

Nitrosomethomyl

The Agency has considered the problem of the formation of nitrosomethomyl. Potentially, methomyl can be converted to nitrosomethomyl during manufacturing processes or *in vivo* following the ingestion of residues of methomyl. Data on the manufacturing processes for technical methomyl indicate that theoretically it is unlikely that nitrosomethomyl will be formed during the manufacture of methomyl. The possibility does exist that nitrosation of the methylcarbamoyl group of methomyl will occur during storage if nitrosating agents are added during formulation. Registrants must submit the results of analyses of methomyl products for nitrosomethomyl, or alternatively, a certification that nitrosating agents are not added to methomyl products. Studies have been reviewed that indicate that nitrosomethomyl is mutagenic and oncogenic. However, no evidence is available to indicate that methomyl converts to nitrosomethomyl *in vivo*. Based on available data, the formation of nitrosomethyl during the manufacturing processes or *in vivo* does not present cause for concern.

Cholinesterase Depression

Methomyl, like many carbamate insecticides, causes acetylcholinesterase depression. In a chronic feeding study in beagle dogs, the animals were fed 0, 50, 100, 400, or 1,000 ppm of methomyl in their diet. Dose-related histopathology was observed in the kidney and spleen in the 400 ppm and 1,000 ppm dose groups and in the liver and bone marrow in 1,000 ppm group. Anticholinesterase effects were reported in the 1,000 ppm group. A NOEL was set at 100 ppm based on the dose-related histopathological effects.

Based on a NOEL of 100 ppm, an acceptable daily intake (ADI) of 0.025 mg/kg/day has been calculated. Assuming that residues are at tolerance levels and 51% of the ADI is in the average diet of 1.5 kg/day.

Reentry

Several studies have been reviewed concerning the cholinesterase activity of fieldworkers exposed to methomyl. Data indicate that workers involved in the mixing or aerial application of methomyl and workers exposed to foliar residues showed depressed blood cholinesterase levels.

A 2-day reentry interval has been established in California for citrus, grapes, nectarines, and peaches. The Agency has decided to adopt this 2-day reentry level imposed by the Dept. of Food and Agriculture for the State of California (California Administrative Code, January 4, 1979, Article 23, 2479(h), Field Worker Safety) for these methomyl crop uses. Registrants have the option of accepting the 2-day reentry interval or of supplying exposure data, a dislodgeable residue decline curve and establishing an appropriate reentry interval based on this data.

Accident Reports

Three methomyl formulations were classified in 1978 as restricted use pesticides: concentrated solution formulations, 90% soluble concentrate formulations not in water soluble bags, and 1-5% baits, excluding the 1% fly bait.

The accidents reported to the Pesticide Incident Monitoring System (PIMS) involving human exposure to methomyl provided the basis for restricting the use of concentrated solutions and 90% soluble concentrate solids which were not packaged in water soluble bags in 1978. Since most of the problems with methomyl have occurred during mixing and loading operations, the Agency has determined that restricting the use of formulations in non-water soluble bags to use by certified applicators would greatly reduce the hazard. Formulations packaged in water soluble bags will remain available for general use.

Section 162.11(c)(4-5) of the Regulations for the Enforcement of the Federal Insecticide, Fungicide, and Rodenticide Act states that any product use(s) which meets the general use criteria stated in Section 162.11(c)(1-3) shall nonetheless be classified for restricted use if the Agency determines that based on human toxicological data (including epidemiological studies), use history, accident data, monitoring data, or such other evidence as the Administrator identifies the product use(s) may pose a serious hazard to man or the environment which can reasonably be prevented by classification for restricted use. Any product use(s) classified for restricted use under the provisions above may be limited to use by or under the direct supervision of a certified applicator.

A decrease in the number of incidents of human exposure reported to PIMS for 1979, 1980, and 1981 was noted after the publication of the final rule in 1978 to restrict certain uses of methomyl. This factor supports the Agency's decision to continue the restriction to limit specific formulation of methomyl to use by certified applicators. The packaging of water soluble powders in water soluble bags has reduced the incidence of human exposures and, also will remain in effect.

Wildlife Hazard

The acute toxicity of methomyl to mammals at 17-24 mg/kg is considered to be high. The greatest risk to wild mammals, as determined from available information, is from exposure to the 1-2.5% bait formulations (except the 1% fly bait). These uses will remain restricted until requested ecological effects data are submitted to allow for a complete assessment of the hazard to mammalian wildlife.

Section 3(c)8 of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) directs the Agency not to initiate a Rebuttable Presumption Against Registration action unless the action is based on a validated test or other significant evidence raising prudent concerns of unreasonable adverse effects to man or the environment. Available data do not indicate that the use of methomyl will result in unreasonable adverse effects.

Criteria for Registration Under this Standard

To be subject to this Standard, methomyl products must meet the following conditions:

1. contain methomyl as the sole active ingredient;
2. be within acceptable standards of product composition;
3. be within acceptable acute toxicity limits;
4. be labeled for acceptable end-uses; and
5. bear required labeling.

Manufacturing-use methomyl products must bear label directions for formulation into acceptable end-uses.

The applicant for registration or reregistration of methomyl products subject to the Standard must comply with all terms and conditions described in this Standard, including commitment to fill data gaps on a time schedule specified by the Agency and, when applicable, offer to pay compensation to the extent required by 3(c)(1)(D) and 3(c)(2)(D) of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended, 7 U.S.C. 136 (c)(1)(D) and 136 (c)(2)(D). As discussed in Chapter 1, applicants for the registration of methomyl products under this Standard must contact the Agency for specific instructions, including updated information on data requirements and companies whose data must be cited and to whom compensation must be offered.

A. Manufacturing-use Methomyl

1. Acceptable Ranges and Limits

a. Product Composition Standards

There are four currently registered manufacturing use methomyl products of which two are technical methomyl products (98% and 95% methomyl) and two are formulation intermediate products (90% and 26% methomyl). To be covered under this Standard, manufacturing-use products must contain methomyl as the sole active ingredient. Any percentage of active ingredient is acceptable with appropriate certification of limits.

A discussion of the formation of unintended substances has not been submitted for any methomyl-containing product. The manufacturing processes for technical methomyl are unlikely to result in the formation of nitrosamines. However, the possibility exists that nitrosation of the methyl-carbamoyl group of methomyl will occur during storage if nitrosating agents are added during formulation. The Agency requires analyses of methomyl-containing products for nitrosomethomyl or a certification from registrants that nitrosating agents are not added to methomyl-containing products.

b. Acute Toxicity Limits

The Agency will consider registration of manufacturing-use methomyl products which have established acute toxicity category I-IV ratings for each of the following effects:

Acute Oral Toxicity
Acute Dermal Toxicity
Acute Inhalation Toxicity
Primary Eye Irritation
Primary Dermal Irritation

c. Use Patterns

To be covered under this Standard, manufacturing-use methomyl products must be labeled for formulation into end-use pesticides which are intended for outdoor, domestic/nondomestic, terrestrial applications (food or non-food uses), or other uses accepted by the Agency.

Tolerences have been established for the use methomyl on food crops and are presented in the Residue Chemistry Chapter of this Standard. The Agency will consider additional tolerances on food or feed crops provided that applicants submit a petition(s) proposing a tolerance level for each crop, supply appropriate residue data, and demonstrate that the addtion of the tolerance will not result in an unacceptable risk to the general population. The Agency will consider additional tolerances because only 51% of the ADI is in the average diet of 1.5 kg/day.

2. Required Labeling

All manufacturing-use methomyl products must bear appropriate labeling as specified in 40 CFR 162.10.

3. Tolerance Reassessment

The chemical name of the active ingredient for methomyl is S-methyl N-[(methylcarbamoyl)oxy]thioacetimidate. Methomyl, in plants, is degraded to the volatile metabolites acetonitrile and CO_2. Neither the hydrolysis product of methomyl, S-methyl N-hydroxythioacetimidate, nor its glucoside conjugate have been identified as metabolites of methomyl in plants. Additionally, the S-oxide and S,S-dioxides of methomyl have not been found in plant metabolism studies. The metabolism of methomyl in food-producing animals has not yet been defined. Methomyl per se is the only residue of concern in plants.

An adequate, validated analytical method (gas-liquid chromatography) is available. The recovery of methomyl from fortified crop samples is good for most raw agricultural commodities and the sensitivity of the method is 0.02 to 0.05 ppm. The method is published in the Pesticide Analytical Manual, Volume II.

Tolerances for residues of methomyl have been established for a wide variety of food crops (40 CFR 180.253). Tolerances for each crop can be found in the Residue Chemistry Chapter (Chapter 7) or Appendix A of this Standard.

The toxicology data base utilized to support the tolerances on food crops is presented and discussed in the Toxicology Chapter of this Standard (Chapter VI). A 2-year chronic feeding study in beagle dogs was used to establish a NOEL of 100 ppm for systemic effects. The animals were fed 0, 50, 100, 400, or 1000 ppm of methomyl in the diet. Dose-related histopathology was observed in the kidney and spleen of 400 ppm and 1000 ppm dogs and the liver and bone marrow of the dogs in the 1000 ppm dose group.

Based on the toxicology data described above, an acceptable daily intake of methomyl in the diet is calculated to be 0.025 mg/kg/day (assuming a 60 kg person and 1.5 kg daily intake). Assuming residues in crops are at tolerance level, the theoretical maximum residue contribution (TMRC) is calculated to be 0.77 mg/day. From these calculations a diet of 1.5 kg contains 51% of the acceptable daily intake of methomyl. Tolerances on the following crops are currently pending: peppers (1.8 ppm), tomatoes (0.8 ppm), onions (2.8 ppm), pears (2.0 ppm), and pineapples (0.2 ppm). If adopted, the TMRC would be 0.8556 mg/day and the percent of the ADI in the diet would be 57.04.

Codex maximum residue limits have not yet been recommended for methomyl because a suitable ADI for methomyl has not been agreed upon by participating countries. Methomyl tolerances have been established in some foreign countries that import food from the United States. A table listing Canadian and Mexican tolerances for residues of methomyl are presented in the Residue Chemistry Chapter of this Standard (Chapter VII).

Tolerances for residues of methomyl in or on oranges, chili peppers, and tomatoes are higher in Mexico than in the U.S. and a tolerance for residues on pineapple has been established in Mexico but not in the U.S. Registration actions pending in the U.S. would result, if adopted, in tolerances of 0.2, 1.0, 2.0 ppm in or on pineapple, tomatoes, and peppers, respectively, and would correspond to Mexican tolerances. A decision to raise the 2 ppm U.S. tolerance on oranges to match the 5 ppm Mexican tolerance should be deferred until a determination is made on the Codex MRL's by Mexico.

There are six tolerances for methomyl in Canada. The tolerances for apples, celery, citrus, grapes, and lettuce are lower than those established by the U.S. The tolerance on cabbage is the same as the tolerance set in the U.S.

In the future, the Agency may alter certain established methomyl tolerances to accomodate a crop grouping scheme. The crop groups are: leafy vegetables, Brassica leafy vegetables, legume vegetables, fruiting vegetables and small grains.

The result of the tolerance reassessment is to allow most tolerances to remain unchanged. To conform to current policy that separate tolerances be established for the forage and for the hay or straw of grains, grasses, and legumes, 40 CFR 180.253 should be amended as follows:

Delete tolerance(s) for:	Alfalfa	10 ppm
Add tolerance(s) for:	Alfalfa, fresh	10 ppm
	Alfalfa, hay	10 ppm
	Beans, hay	10 ppm
	Peavine, hay	10 ppm
	Soybeans, hay	10 ppm

B. End-Use Methomyl: Soluble Concentrates-Solid, Liquid

1. Acceptable Ranges and Limits

a. Product Composition Standards

End use soluble concentrate methomyl products with any percentage of active ingredient are acceptable under this Standard with appropriate certification of limits.

Inert ingredients in food-use formulations must be cleared for such use under 40 CFR 180.1001. Registrants of end use products with inert ingredients that have not been cleared in 40 CFR 180.1001 must either remove the ingredient from the product or obtain clearance.

b. Acute Toxicity Limits

The Agency will consider registration of soluble concentrate methomyl products not packaged in water soluble bags as restricted use pesticides. Restricted use pesticides can only be applied by certified pesticide applicators or individuals under their direct supervision. Established acute toxicity category I-IV ratings will be acceptable for these products for each of the following effects:

Acute Oral Toxicity
Acute Dermal Toxicity
Acute Inhalation Toxicity
Primary Eye Irritation
Primary Dermal Irritation

The Agency will consider registration of soluble concentrate methomyl products packaged in water soluble bags for general use. Established acute toxicity category I-IV ratings will be acceptable for these products for each of the following effects:

Acute Oral Toxicity
Acute Dermal Toxicity
Acute Inhalation Toxicity
Primary Eye Irritation
Primary Dermal Irritation

Toxicity Category I will be accepted for nondomestic, general use because the water soluble bags reduce exposure considerably. Accident reports have shown that the mixing and loading activities cause the greatest exposure potential. The packaging of methomyl in water soluble bags reduces the exposure potential.

c. Use Patterns

To be covered under this Standard, soluble concentrate products of methomyl may be intended for food/nonfood, terrestrial, outdoor use. Soluble concentrate methomyl products in non-water soluble bags may only be applied by certified applicators or individuals under their direct supervision. Soluble concentrate methomyl products in water soluble bags may be registered only for nondomestic (general) use.

Reentry Intervals

The Agency has accepted the California State reentry interval of 2 days for the use of soluble concentrate methomyl products on citrus, grapes, nectarines, and peaches when applied at existing application rates.

Registrants of soluble concentrate methomyl products have the option of accepting the California reentry interval of 2 days for the use of methomyl on citrus, grapes, nectarines and peaches, or of petitioning for relief based upon local exposure and residue data.

Federally recommended reentry intervals for the use of methomyl on the following crops cannot be established at this time due to the lack of data needed to establish safe reentry intervals: alfalfa, apples, asparagus, beans, blueberries, broccoli, brussel sprouts, cabbage, carrots, cauliflower, celery, collards, corn, cotton, cucumbers, lettuce, melons, mint, onion, peanuts, peas, peppers, potatoes, sorghum, soybeans, summer squash, spinach, sugar beets, tobacco, tomatoes, forest trees (ground application) and ornamentals. Reentry intervals may need to be reassessed following the completion of Agency reentry guidelines.

Preharvest Intervals

Preharvest intervals for the use of methomyl on the crops listed below remain in effect. These intervals have been reassessed and appear to be adequate to insure residue levels in raw agricultural commodities below tolerance limits at harvest. The current preharvest intervals are as follows:

CROP	PREHARVEST INTERVAL
Alfalfa	7 days
Apples	8 days
Asparagus	1 day
Avocados	1 day
Beans	
green vines (forage)	3 days
vines for hay	7 days
Blueberries	3 days
Broccoli	3 days
Brussel Sprouts	
Cabbage	1 day
Cauliflower	
Celery	7 days
Citrus (fruit)	1 day*
Corn (ears)	0 days
Cotton	15 days
Cucurbits	1-3 days
Grain crops (grain	7 days
Grapes	
Fresh grapes/raisins	1 day*
Grapes for wine	14 days
Grass, Bermuda	
Bermuda grass	7 days
Bermuda grass hay	3 days
Lentils	25 days
Lettuce	7-10 days (varies with application rates)

Mint, hay	14 days	
Nectarines	1 day*	
Peaches	4 days	
Peanuts	21 days	
Peas		
Peas	1 day	
Pea vines for feed	5 days	
Forage for hay	14 days	
Pecans	30 days	
Pomegranates	14 days	
Soybeans	3-12 days	(varies with application rates)
Spinach	7 days	
Strawberries		
Fresh	3 days	
Processed	10 days	
Tobacco	5 days	(flue-cured)
	14 days	(air or fire cured)
Vegetables, fruiting	1-2 days	(varies with application rate)
Vegetables, leafy	10 days	
Vegetables, root crop		
Carrots	1 day	
Onions		
green	28 days	
dry bulb	7 days	
Potatoes	6 days	
Sugar Beets		
roots	7 days	
tops	30 days	

A prohibition against grazing or feeding cover crops in methomyl-treated orchards replaces the current restriction against grazing or feeding cover crops within 10 days of treatment.

*NOTE: Although the current preharvest interval for the use of methomyl on citrus, grapes and nectarines is sufficient to insure residue levels below tolerance limits at harvest, because of worker safety concerns, reentry into treated fields is prohibited within 2 days of application. Registrants have the option of accepting this restriction or of petitioning for relief based upon local exposure and residue data.

Application Rate

The Agency finds that it must limit application rates to current levels. This is an interim measure which may need to be reassessed following the receipt of required data to complete the hazard evaluation. Existing application rates for each use are presented in the Appendix A of this Standard.

2. Required Labeling

All soluble concentrate methomyl products must bear appropriate labeling as specified in 40 CFR 162.10. Soluble concentrate product in non-water soluble bags must also bear restricted use labeling.

Reentry

All soluble concentrate methomyl products must bear appropriate labeling as specified in 40 CFR 162.10. Soluble concentrate products in non-water soluble bags must also bear restricted use labeling.

"Reentry into treated fields is prohibited within 2 days of application"

All labels and labeling intended for citrus, grapes, nectarines, and peaches must bear following statement: "This product must be applied in accordance with 40 CFR Part 170". Registrants may state the contents of 40 CFR Part 170 or additional statements.

Additional Restrictions and Precautionary Statements

All soluble concentrate products in water soluble bags must bear the following restrictions on the label:

> "Not for use or storage in or around domestic dwellings."
>
> "Do not feed or graze livestock on cover crops in methomyl-treated orchards."

C. End-Use Methomyl: Granular Formulations

a. Product Composition Standards

End-use granular formulations of methomyl with any percentage of active ingredient are acceptable under this Standard with appropriate certification of limits.

Inert ingredients in food-use formulations must be cleared for such use under 40 CFR 180.1001. Currently there are two inert ingredients in granular methomyl products that have not been cleared for use on food. The two inert ingredients are listed in the Confidential Appendix to this Standard. Registrants of end-use products with inert ingredients that have not been cleared in 40 CFR 180.1001 must either remove the ingredient from the product or obtain clearance.

b. Acute Toxicity Limits

The Agency will consider registration of granular methomyl products that have the following acute toxicity category ratings:

	I	II	III	IV
Acute Oral Toxicity	amendment required	yes	yes	yes
Acute Dermal Toxiciiy	amendment required	yes	yes	yes
Acute Inhalation Toxicity	amendment required	yes	yes	yes
Primary Eye Irritation	amendment required	yes	yes	yes
Primary Dermal Irritation	amendment required	yes	yes	yes

c. Use Patterns

To be registered under this Standard, granular products of methomyl may be registered for food/nonfood, terrestrial, outdoor use. The 1-5% baits excluding the 1% fly bait are restricted use pesticides. These products can only be applied by certified applicators or individuals under their direct supervision.

Reentry Intervals

The Agency has accepted the California State reentry interval of 2 days for the use of granular methomyl products on citrus, grapes, nectarines, and peaches when applied at existing application rates.

Registrants of granular methomyl products have the option of accepting the California reentry interval of 2 days for the use of methomyl on citrus, grapes, nectarines and peaches, or of petitioning for relief based upon local exposure and residue data.

Federally recommended reentry intervals for the use of methomyl on the following crops cannot be established at this time due to the lack of data needed to establish safe reentry intervals: alfalfa, apples, asparagus, beans, bluberries, broccoli, brussel sprouts, cabbage, carrots, cauliflower, celery, collards, corn, cotton, cucumbers, lettuce, melons, mint, onion, peanuts, peas, peppers, potatoes, sorghum, soybeans, summer squash, spinach, sugar beets, tobacco, tomatoes, forest trees and ornamentals. Reentry intervals may need to be reassessed following the completion of Agency reentry guidelines.

Preharvest Intervals

Existing preharvest intervals for the use of methomyl on crops remain in effect. These intervals have been reassessed and appear to be adequate to insure residue levels in raw agricultural commodities below tolerance limits at harvest. The currently recommended preharvest intervals are listed under the section entitled "End-Use Methomyl: Soluble Concentrates - Solid, Liquid" of this Chapter.

Application Rate

The Agency finds that it must limit application rates to current levels. This is an interim measure which may need to be reassessed following the receipt of required data to complete the hazard evaluation. Existing application rates for each use are presented in the Residue Chemistry Chapter of this Standard.

To be registered under this Standard, granular products of methomyl may be registered for food/nonfood, terrestrial, outdoor use. The 1-5% baits excluding the 1% fly bait are restricted use pesticides. These products can only be applied by certified applicators or individuals under their direct supervision.

2. Required Labeling

All granular methomyl products must bear appropriate labeling as specified in specified in 40 CFR 162.10. Granular products in non-water soluble bags must also bear restricted use labeling.

Reentry

All granular methomyl products intended for application on citrus, grapes, nectarines, and peaches must bear the following on the label:

"Reentry into treated fields is prohibited within 2 days of application"

All labels and labeling intended for products applied to these crops must bear the following statement: "This product must be applied in accordance with 40 CFR Part 170". Registrants may state the contents of 40 CFR Part 170 or additional statements.

Additional Restricitons and Precautionary Statements

"Do not feed or graze livestock on cover crops in methomyl-treated orchards"

D. End-Use Methomyl: Dust Formulations

1. Acceptable Ranges and Limits

a. Product Composition Standards

End-use dust formulations of methomyl with any percentage of active ingredient are acceptable uinder this Standard with appropriate certification of limits.

Inert ingredients in food-use formulations must be cleared for such use under 40 CFR 180.1001. Registrants of end-use products with inert ingredients that have not been cleared in 40 CFR 180.1001 must either remove the ingredient from the product or obtain clearance.

b. Acute Toxicity Limits

The Agency will consider registration of methomyl dust products that have the following category ratings:

	I	II	III	IV
Acute Oral Toxicity	amendment required	yes	yes	yes
Acute Dermal Toxicity	amendment required	yes	yes	yes
Acute Inhalation Toxicity	amendment required	yes	yes	yes
Primary Eye Irritation	amendment required	yes	yes	yes
Primary Dermal Irritation	amendment required	yes	yes	yes

c. Use Patterns

To be registered under this Standard, methomyl dust products may be registered for food/nonfood, terrestrial, outdoor, domestic and nondomestic use.

Reentry Intervals

The Agency has accepted the California State reentry interval of 2 days for the use of dust methomyl products on citrus, grapes, nectarines, and peaches when applied at existing application rates.

Registrants of dust methomyl products have the option of accepting the California reentry interval of 2 days for the use of methomyl on citrus, grapes, nectarines and peaches, or of petitioning for relief based upon local exposure and residue data.

Federally recommended reentry intervals for the use of methomyl on the following crops cannot be established at this time due to the lack of data needed to establish safe reentry intervals: alfalfa, apples, asparagus, beans, bluberries, broccoli, brussel sprouts, cabbage, carrots, cauliflower, celery, collards, corn, cotton, cucumbers, lettuce, melons, mint, onion, peanuts, peas, peppers, potatoes, sorghum, soybeans, summer squash, spinach, sugar beets, tobacco, tomatoes, forest trees and ornamentals. Reentry intervals may need to be reassessed following the completion of Agency reentry guidelines.

Preharvest Intervals

Existing preharvest intervals for the use of methomyl on crops remain in effect. These intervals have been reassessed and appear to be adequate to insure residue levels in raw agricultural commodities below tolerance limits at harvest. The currently recommended preharvest intervals are listed under the section entitled "End-Use Methomyl: Soluble Concentrates - Solid, Liquid" of this Chapter.

Application Rate

The Agency finds that it must limit application rates to current levels. This is an interim measure which may need to be reassessed following the receipt of required data to complete the hazard evaluation. Existing application rates for each use are presented in the Residue Chemistry Chapter of this Standard.

2. Required Labeling

All dust formulations of methomyl must bear appropriate labeling as specified in 40 CFR 162.10. Dusts product in non-water soluble bags must also bear restricted use labeling.

Reentry

All dust methomyl products intended for application on crops must include the following precaution:

"Reentry into treated fields is prohibited within 2 days of application."

All labels and labeling intended for agricultural use products must bear the following statement: "This product must be applied in accordance with 40 CFR Part 170." Registrants may state the contents of 40 CFR Part 170 or additional statements.

Additional Restrictions and Precautionary Statements

"Do not feed or graze livestock on cover crops in methomyl-treated orchards"

CHAPTER III

Data Requirements and Data Gaps

Manufacturing-Use Methomyl

Table A entitled, Generic Data Requirements includes those data that pertain to the properties or effects of methomyl as an active ingredient. Thus, these data are relevant to an evaluation of the risks and benefits of all products containing methomyl. Providing data to fill indicated gaps is the primary responsibility of the manufacturing-use product registrant(s). Registrants of end-use products which are not exempted by FIFRA Section 3(c)(2)(D) are also responsible for the submission of these data. Applicants for the registration or reregistration of manufacturing-use methomyl products must acknowledge reliance on existing data which fill indicated data requirements under FIFRA 3(c)(1)(D). These data are listed under the column entitled Bibliographic Citation in this table. All data requirements are required for all currently registered use patterns unless a footnote to the table specifies otherwise.

Table B, entitled Product-Specific Data Requirements for Methomyl Manufacturing-Use Products ,includes those data that relate only to the properties or effects of a product with a specific composition. Thus, these data are required of each product to characterize the product's particular composition and physical/chemical properties, and acute toxicity. Providing data to fulfill these data requirements for a particular product is the responsibility of each applicant for the registration or reregistration of a manufacturing-use methomyl product. If the Agency has in its possession product-specific data which fulfill a data requirment for a particular product, this is indicated in the guidance package accompanying this Standard.

Applicants for the registration of new manufacturing-use methomyl products must submit all required product specific data or establish that the proposed product is substantially similar to another product for which the Agency has received acceptable product specific data.

If the Agency has determined that one or more existing manufacturing-use methomyl products are substantially similar, then this, too, is indicated. Product specific data need not be acknowledged under FIFRA 3(c)(1)(D) unless the Agency or a registrant has established that a product is substantially similar to another product for which the Agency has received acceptable product specific data. If this should occur, the registrant(s) of the former product(s) is required to acknowledge reliance on these data.

End Use Products of Methomyl

Registrants of end-use methomyl products not exempt by FIFRA Section 3(c)(2)(D) are responsible for the submission of "generic" data described in Tables A and B of this Chapter, in addition to the product specific data listed in Table C.

Registrants of all end-use methomyl products are advised that if data are not generated to fill generic data requirements for the manufacturing-use product(s), these registrations will be suspended. If continued availability of the manufacturing-use product is desired, this data must be supplied. Table C, entitled Product-Specific Data Requirements for Methomyl End-Use

Products ,includes those data that relate only to the properties or effects of an end-use product with specific composition.

Table A

Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Product Chemistry						
163.61-3(b)	Identification	Yes	Technical Grade	Partial	Product CSF's	Yes: 6 months
163.61-8(c)(1)	Color	Yes	Technical Grade	Yes	Shell, 1975 05012838 duPont, 1977 00008553	No
163.61-8(c)(2)	Odor	Yes	Technical Grade	Yes	Shell, 1975 05012838 duPont, 1977 00008553	No
163.61-8(c)(3)	Melting Point	Yes	Technical Grade	Yes	Shell, 1975 05012838 duPont, 1977 00008553	No
163.61-8(c)(4)	Solubility	Yes	Technical Grade	Yes	Shell, 1975 05012838 duPont, 1977 00008553	No
163.61-8(c)(5)	Stability	Yes	Technical Grade	Yes	Shell, 1975 05012838 duPont, 1977 00008553	No
163.61-8(c)(6)	Octanol/water Partition/ Coefficient	Yes	Technical Grade	No	—	Yes: 6 months

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table A

Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Product Chemistry (cont.)						
163.61-8(7)	Physical State	Yes	Technical Grade	Yes	Shell, 1975 05012838 duPont, 1977 00008553	No
163.61-8(c)(8)	Density or Specific Gravity	Yes	Technical Grade	Yes	Shell, 1975 05012838 duPont, 1977 00008553	No
163.61-8(c)(10)	Vapor Pressure	Yes	Technical Grade	Yes	Shell, 1975 05012838 duPont, 1977 00008553	No
163.61-8(c)(11)	pH	Yes	Technical Grade	No	—	Yes: 6 months

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table A

Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Environmental Fate						
163.62-7(b)	Hydrolysis	Yes1/	Technical Grade2/	No	-	Yes: 6 months
163.62-7(c)	Photodegradation	Yes1/	Technical Grade2/	No	-	Yes: 6 months
163.62-8(b)	Aerobic soil metabolism	Yes1/	Technical Grade2/	Partial	Harvey, 1977, 00009325 Harvey, 1964?, 00008844 Harvey, 1977, 00008567 Harvey, 1977, 0008568	Yes: 24 months
163:62-8(c)	Anaerobic soil metabolism	Yes1/	Technical Grade2/	No	-	Yes: 24 months
163.62-8(d)	Anaerobic aquatic metabolism	No1/				
163.62-8(e)	Aerobic aquatic metabolism	No1/				

1/ Not required for use around non-domestic buildings.
2/ Radio-labeled analytical grade or non-radio-labeled technical grade.

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table A

Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Environmental Fate						
163.62-8(f)	Microbial metabolism					
	(2) effects of microbes on pesticides	Reserved[3/]				
	(3) effects of pesticides on microbes	Reserved[3/]				
163.62-8(g)	Activated sludge metabolism	Reserved[3/]				
163.62-9(b)	Leaching	Yes[1/,4/]	Technical Grade[2/]	No	-	Yes: 12 months
163.62-9(c)	Volatility	Yes[1/]	Representative Formulation	No	-	Yes: 12 months
163.62-9(d)	Adsorption/ desorption	Yes[1/,5/]	Technical Grade[2/]	No	-	Yes: 12 months
163.62-9(e)	Water dispersal	No				

1/ Not required for use around non-domestic buildings.
2/ Radio-labeled analytical grade or non-radio labeled technical grade.
3/ This requirement for the submission of data is currently being reserved pending the review and modification of testing protocols.
4/ For terrestrial noncrop uses, orchard crop uses, field-vegetable crop uses, and forestry uses, the mobility of the test substance and its degradates in soil shall be assessed either by soil thin layer chromotography, soil column, or batch equilibrium (adsorption/desorption) procedures.
5/ For domestic outdoor uses, greenhouse uses, aquatic uses, and aquatic impact uses, the mobility of the test substance and its degradates in soil shall be assessed only by the batch equilibrium (adsorption /desorption) procedure.

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table A

Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Environmental Fate						
163.62-10(b)	Terrestrial field dissipation					
	(1) Field & vegetable crop	Yes	Representative Formulation	No	-	Yes: 24 months
	(2) Tree Fruit & nut crop uses	Yes	Representative Formulation	No	-	Yes: 24 months
	(3) Pasture land uses	No				
	(4) Domestic outdoor parks, ornamentals and turf uses, forest	Yes	Representative Formulation	No	-	Yes: 24 months
	(5) Rights of way, shelterbelts and related uses	No				
163.62-10(c)	Aquatic field dissipation (1) Aquatic food crop uses (2) Aquatic noncrop uses (3) Specialized aquatic uses	No				

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table A

Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Environmental Fate						
163.62-10(d)	Terrestrial/ aquatic (forest) field dissipation	Yes	Representative Formulation	No		Yes: 24 months
163.62-10(e)	Aquatic impact uses (1) Direct discharge (2) Indirect discharge (3) Wastewater treatment	No				
163.62-10(f)	Combination and tank mix field dissipation	No				
163.62-10(g)	Long term field dissipation study	Reserved[6]				
163.62-11(b)	Accumulation in rotational crops (field and vegetable crops)	Yes	Radio-labeled[7] analytical grade	No	-	Yes: 24 months

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6/ The requirement for the submission of these data are reserved pending the receipt of results of short term terrestrial field dissipation studies (Sections 163.62-10(b)(1)(2)(4)).

7/ Radio-labeled analytical grade; if radioactive residues are found, field test must be conducted with representative formulated product.

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table A

Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Environmental Fate						
163.62-11(c)	Accumulation in irrigated crops	No				
163.62-11(d)	Fish accumulation	Yes[1/,8/]	Radio-labeled analytical grade or non-labeled technical grade	No	-	Yes: 12 months
163.62-11(e)	Special studies accumulation in aquatic noncrop uses	No				
	Re-entry	Yes[1/]	Representative Formulation	No	-	Yes: 12 months
163.62-13	Disposal and storage	No				

1/ Not required for use around non-domestic buildings.
8/ Flow through only.

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table A

Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Toxicology						
163.81-1	Acute Oral Toxicity	Yes	Each product or substantially similar product	Yes	Sherman, 1966, 00009227	No
163.81-2	Acute Dermal Toxicity	Yes	Each product or substantially similar product	Yes	Dashiell, 1971, 00007974	No
163.81-7	Acute Neurotoxicity	Yes	Technical Grade	Yes	Krauss and Stala, 1967, 00008827	No
163.82-1	Subchronic Oral Toxicity	Yes	Technical Grade	Yes	Paynter, 1966, 00007190 Lintal et al., 1979, 05018063 Bracy et al., 1979, 050020053 Sherman, 1964, 00009228 Sherman, 1967, 00009010 duPont, 1967, 00008832	No
163.82-2	Subchronic 21-day Dermal Toxicity	Yes	Technical Grade	Yes	Busey, 1967, 00009234	No
163.82-3	Subchronic 90-day Dermal Toxicity	No				
163.83-4	Subchronic Inhalation Toxicity	No				

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table A

Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Toxicology						
163.83-1	Chronic Feeding	Yes	Technical Grade	Yes	Busey, 1968, 00007092 Busey, 1968, 00007091	No
163.83-2	Oncogenicity	Yes	Technical Grade	Partial	Busey 1968, 00007092	Yes: 24 months 1/
163.83-3	Teratogenicity	Yes	Technical Grade	Partial	Roger et al., 1978, 00008621	Yes: 24 months 2/
163.83-4	Reproduction	Yes	Technical Grade	Yes	Kundzin, 1978, 00007093	No
163.84-2 through 4	Mutagenicity	Yes	Technical Grade	Partial	Simmon et al., 1977, 05009139	Yes: 12 months 3/
163.85-1	Metabolism	Yes	Technical Grade	Yes	Harvey et al., 1973, 05008198	No

1/ Oncogenicity testing in mice is required.
2/ Teratogencity testing in rabbits is required.
3/ A mammalian in vitro point mutation test and a mammalian in vitro or in vivo cytogentics test are required.

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table A

Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Residue Chemistry						
	Metabolism in Plants	Yes	Representative Formulation	Yes	Harvey and Reiser, 1973, 05008206	No
	Metabolism in Food Producing Animals	Yes	Representative Formulation	No	—	Yes: 12 months
	Analytical Methods	Yes	Representative Formulation	Yes	Pease and Kirkland, 1977, 00009009 Pease, 1969, 00009074 duPont, 1968 GS-0028-0016 Shell Developent Co., 1975, 00007132 Pease, 1968, 00008837	No

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table A

Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Residue Chemistry						
	Residue Data:					
	Alfalfa	Yes	Representative Formulation	Yes	duPont, 1970 00008984 duPont, 1973, 00007159 Shell, 1975, 00008039 Shell, 1976, 00007133	No
	Apples	Yes	Representative Formulation	Yes	duPont, 1976 GS-0028-0024 duPont, 1971, 00007077	No

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table A

Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Residue Chemistry						
	Asparagus	Yes	Representative Formulation	Yes	duPont, 1975, 00008938	No
	Avocados	Yes	Representative Formulation	Yes	duPont, 1978, GS-0028-0005	No
	Beans	Yes	Representative Formulation	Yes	duPont, 1974, 00009154 Shell, 1975, 00007134 duPont, 1971, 00008264 duPont, 1973, 00007168 duPont, 1974, GS-0028-0021 Shell, 1976, 00007135	No
	Blueberries	Yes	Representative Formulation	Yes	duPont, 1976, 00008334	No
	Broccoli	Yes	Representative Formulation	Yes	duPont, 1968, 00008043 duPont, 1974, GS-0028-0001 Shell, 1976 000007604	No

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table A

Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Residue Chemistry						
	Brussels Sprouts	Yes	Representative Formulation	Partial	duPont, 1968, 00008043 duPont, 1974, GS-0028-0001	Yes: 12 months3/
	Cabbage	Yes	Representative Formulation	Partial	duPont, 1967, 00007928 duPont, 1972, 00007039 WARF, 1973 00007715 duPont, 1971, 00008964 duPont, 1973, 00007168 duPont, 1972, 00008679	Yes: 12 months3/
	Cauliflower	Yes	Representative Formulation	Partial	duPont, 1968, 00008043 duPont, 1974, GS-0028-0001 Shell, 1976 00007605	Yes: 12 months4/

3/ Data are required for residues resulting from aerial application.
4/ Data are required for residues resulting from application of dusts.

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table A

Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Residue Chemistry						
	Celery	Yes	Representative Formulation	Yes	duPont, 1969, 00008803 duPont, 1974, GS-0028-0001 duPont, 1972, 00008679 Shell, 1975, 00007136	No
	Citrus	Yes	Representative Formulation	Yes	duPont, 1972, 00009070 Shell, 1975, 00007140 Shell, 1975, 00007137 Shell, 1975, 00007138 Shell, 1975, 00007139	No

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table A

Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Residue Chemistry						
	Corn	Yes	Representative Formulation	Partial	duPont, 1967, 00007659 duPont, 1968, 00008838 duPont, 1972, 00007039 Shell, 1976, 00007142	Yes: 12 months5/
	Cottonseed	Yes	Representative Formulation	Yes	duPont, 1974, 00009135 duPont, 1973 00007690 Shell, 1975, 00007989 Shell, 1976 00009075 duPont, 1976, 00009378	No

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5/ Additional data on residues in cannery wastes reflecting the registered use of methomyl (0.5 lb/acre, 0-day PHI) are required. In the absence of additional data, a 3-day PHI for corn ears will be acceptable.

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table A

Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Residue Chemistry						
	Cucurbits	Yes	Representative Formulation	Partial	duPont, 1967, 00009291 duPont, 1972, 00007970 Shell, 1976, 00009077 Shell, 1975, 00009076 Shell, 1975, 00007990	Yes: 12 months[6/]
	Grain Crops	Yes	Representative Formulation	Partial	duPont, 1975, 00007612	Yes: 12 months[3/]
	Grapes	Yes	Representative Formulation	Partial	duPont, 1973 00007634 Shell, 1975, 00007991	Yes: 12 months[7/]

6/ Additional data for aerial application may be required pending clarification of residue data previously submitted. (See discussion of cucurbits in Chapter VII.)

7/ Residue data for grapes grown east of the Rocky Mountains are required.

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table A

Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Resdiue Chemistry						
	Grass, Bermuda	Yes	Representative formulation	Yes	IR-4, 1977, GS-0028-0006 IR-4, 1979, GS-0028-0003	No
	Lentils	Yes	Representative Formulation	Yes	-	No8/
	Lettuce	Yes	Representative Formulation	Yes	duPont, 1971 00008264 duPont, 1972, 00007039 duPont, 1973, 00007168 WARF, 1973, 00007715 duPont, 1971, 00008964 duPont, 1971, 0007175 Shell, 1975, 00007992	No

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8/ The use of methomyl on lentils is supported by residue data for dried beans and soybeans.

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table A

Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Residue Chemistry						
	Mint, hay	Yes	Representative Formulation	Yes	Wellman et al., 1972, 0007044 Wellman et al., 1971, 00007043 Kiigemagi et al., 1976, 00007996	No
	Nectarines & Peaches	Yes	Representative Formulation	Partial	duPont, 1974, 00007832	Yes: 12 months 9/
	Peanuts	Yes	Representative Formulation	Yes	duPont, 1971 00007081 Shell, 1976, 00009078 duPont, 1979?, GS-0028-0004 Shell, 1975, 00007997	No
	Peas	Yes	Representative Formulation	Partial	duPont, 1972, 00007683 duPont, 1974, 00008154 Shell, 1975, 00007999 Shell, 1976, 00009079	Yes: 12 months 10/

9/ Residue data on peaches are required.

10/ Additional data are required for residues resulting from the aerial application of methomyl on peas.

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table A

Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Residue Chemistry						
	Pecans	Yes	Representative Formulation	Yes	duPont, 1976, 00008919	No
	Pomegranates	Yes	Representative Formulation	Yes	duPont, 1975 00009003 LaRue and Dibble, 1975 00009002	No
	Sorghum	Yes	Representative Formulation	Yes	duPont, 1974 00008233 duPont, 1971, 00009366	No
	Soybeans	Yes	Representative Formulation	Yes	duPont, 1979, 00008998 duPont, 1971, 00008264 duPont, 1974, 00008411 duPont, 1976, 00008602 Shell, 1975, 00007008 Shell, 1975, 00009083 Shelll, 195, 00009084	No

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table A

Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Residue Chemistry						
	Spinach	Yes	Representative Formulation	Yes	duPont, 1971, 00007185 duPont, 1974, GS-0028-0001 Shell, 1975, 00007002 Shelll, 1975, 00007001 Shell, 1976, 00007003	No
	Strawberries	Yes	Representative Formulation	Yes	duPont, 1974 00008847 duPont, 1979, 00009004	No
163.64-1	Tobacco	Yes	Representative Formulation	Partial	Leidy et al., 1977, 0500453 Shell, 1975, 00007005 Tappan et al., 1973, 05013872 duPont, 1971, 00008964	Yes: 12 months[11/]

[11/] A residue profile of tobacco smoke is required.

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table A

Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Residue Chemistry						
	Vegetables, Fruiting	Yes	Representative Formulation	Partial	duPont, 1969, 00007094 duPont, 1972, 00007039 Krueger et al., 1973, 05009890 duPont, 1971 00008742 duPont, 1974, 00007626 duPont, 1969, 00009000 Shell, 1975, 00007007 Shell, 1976, 00006996 Shell, 1976, 00006995	Yes: 12 months 12/

12/ Additional residue data for peppers and greenhouse grown tomatoes are required.

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table A
Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Residue Chemistry						
	Vegetables, Leafy	Yes	Representative Formulation	Yes	duPont, 1976 00008535 Hofmaster, 1976, 00008359 Hofmaster, 1976, 00008360 Hofmaster, 1976, 00008361 Hofmaster, 1976, 00008362	No13/

13/ Use of methomyl on beet tops, collards, dandelions, kale, mustard greens, parsley, swiss chard, turnip greens, and watercress is supported by residue data on other leafy vegetables.

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table A

Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Residue Chemistry						
	Vegetables, Root Crop	Yes	Representative Formulation	Yes	duPont, 1974, 00007837 duPont, 1974, 00007192 duPont, 1979 GS-0028-00008 duPont, 1976, GS-0028-0023 duPont, 1969, 00008295 duPont, 1973, 00007161 duPont, 1972, 00008044 Shell, 1975, 000070014	No

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table A

Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Residue Data: Processed Crops						
	Apple Pomace	Yes	Representative Formulation	Yes	duPont, 1972, 00007070	No
	Citrus By-products	Yes	Representative Formulation	Yes	duPont, 1972, 00009070	No
	Milled Grains	Yes	Representative Formulation	Yes	duPont, 1975, 00007612	No
	Mint Oil	Yes	Representative Formulation	Yes	Wellman et al., 1972, 00007044 Wellman et al., 1971, 00007043 Kiigemagi, et al, 1976, 00007996	No
	Oilseed Fractions	Yes	Representative Formulation	Yes	duPont, 1971, GS-0028-0002	No
	Raisins & Grape By-products	Yes	Representative Formulation	Yes	duPont, 1972,? 00007657	No
	Sugarbeet Fractions	Yes	Representative Formulation	No	-	Yes: 12 months
	Tomato Pomace	Yes	Representative Formulation	No	-	No[14/]

14/ Data on apple pomace may be used to fill the residue data requirement for tomato pomace.

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table A

Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Residue Data:						
	Milk and Meat	Yes	Representative Formulation	Partial	duPont, 1967, 00008832	Yes: 12 Months
	Poultry & Eggs By-products	Yes	Representative Formulation	Partial	Sherman, 1972, 00009365	Yes: 12 Months
	Orchard Cover Crop	Yes	Representative[15/] Formulation	No	-	Yes: 12 Months
	Storage Stability	Yes	Technical Grade	Yes	Holt, 1971, 00007071 Niven and Thornberg, 1971, 00007948 duPont, 1971, GS-0028-0002 Wellman, 1972, 00007044 Leidy, 1977, 05008453 duPont, 1974, GS-0028-0018	No

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[15/] Data are required for a representative orchard cover crop to support the use of methomyl on avocados, apples, citrus, peaches, nectarines, pecans, and pomegranates. Alternatively, a restriction against grazing or feeding of cover crops to livestock may be imposed.

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table A

Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Ecological Effects						
163.71-1	Avian Single-Dose Oral LD_{50}	Yes[1/]	Technical Grade	No	—	Yes: 9 months
163.71-2	Avian Dietary LC_{50}	Yes[1/]	Technical Grade	Yes	Heath, 1972, 00010330 Hill, 1975, GS-0028-0200	No
163.71-3	Mammalian Acute Toxicity	Reserved[2/]				
163.71-4	Avian Reproduction	Yes[1/]	Technical Grade	No	—	Yes: 18 months
163.71-5	Simulated and Actual Field Testing for Mammals and Birds	Reserved[2/]				

1/ Not required for use around non-domestic buildings.

2/ The requirement for the submission of the data is currently reserved pending the results of the chronic testing and environmental fate data on run-off.

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table A
Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Ecological Effects						
163.72-1	Fish Acute LC_{50}	Yes[1/]	Technical Grade	Yes	USEPA, 1977, GS-0028-0010; Johnson and Finley, 1980, GS-0028-0026; Goodman, 1977, GS-0028-0022	No
163.72-2	Acute Toxicity to Aquatic Invertebrates	Yes[1/]	Technical Grade	Yes		No
163.72-3	Acute Toxicity to Estaurine and Marine Organisms	Reserved[2/]				
163.72-4	Embryolarvae and Life-cycle Studies of Fish and Aquatic Invertebrates	Yes[1/]	Technical Grade	No	—	Yes: 18 months
163.72-5	Fish Life-Cycle	Reserved[2/]				
163.72-6	Aquatic Organism Accumulation	Reserved[2/]				
163.72-7	Simulated or Actual Field Testing for Aquatic Organisms	Reserved[2/]				

1/ Not required for use around non-domestic buildings.

2/ The requirement for submission of these data is currently reserved pending the results of the chronic testing and environmental fate data on run-off.

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table A

Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Ecological Effects						
163.122-1	Seed Germination	Yes[1/]	Technical Grade	No		Yes: 24 months
163.122-1	Vegetative Vigor	Yes[1/]	Technical Grade	Yes	See Footnote 3	No
163.122-2	Algae	Yes[1/]	Technical Grade	No		Yes: 24 months
162.122-2	Aquatic macrophytes	Yes[1/]	Technical Grade	No		Yes: 24 months

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1/ Not required for use around non-domestic buildings.

3/ The following studies, identified by MRID #, satisfy the data requirement in aggregate: 00007629, 00007702, 00007794, 00007841, 00007914, 00007915, 00007919, 00007959, 00008013, 00008014, 00008025, 00008154, 00008157, 00008161, 00008220, 00008291, 00008322, 00008403, 00008405, 00008409, 00008410, 00008423, 00008433, 00008435, 00008470, 00008497. 00008514, 00008547, 00008703, 00008715, 00008747, 00008765, 00008798, 00008823, 00008859, 00008861, 00008869, 00008873, 00008874, 00008882, 00008946, 00008976, 00008977, 00009053, 00009081, 00009094, 00009101, 00009110, 00009145, 00009146, 00009168, 00009169, 00009177, 00009251, 00009354, 00009359, 00009369, 00009375, 00009384, 00009408, 00009788, 00014256, 00014275, 00014930, 00014962, 00015146, 00015148, 05008155, 05017443.

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table B

Product-Specific Data Requirements for Methomyl Manufacturing-Use Products

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Product Chemistry						
163.61-3	Product Identity and Disclosure of Ingredients	Yes	Each MUP	Yes		Yes: 6 months[1]
163.61-4	Description of Manufacturing Process	Yes	Each MUP	No	—	Yes: 6 months[1]
163.61-5	Discussion of Formation of Unint. Ingredients	Yes	Each MUP	No	—	Yes: 6 months[1]
163.61-6	Declaration and Certification of Ingredient Limits	Yes	Each MUP	No	—	Yes: 6 months[1]
163.61-7	Product Analytical Methods and Data	Yes	Each MUP	Partial[2]	Leitch and Pease, 1973, 05012673 Rossol and Baxter, 1977, 00007014	Yes: 6 months[1]
163.61-8(c)(7)	Physical State	Yes	Each MUP	Yes		Yes: 6 months[1]

1/ These requirements must be fulfilled by each applicant. Data from other applicants may not be cited. Therefore, even if the requirements have been partially or completely filled for some products, no references are given. These requirements must be filled at the time of registration or reregistration.

2/ The product analytical methods submitted satisfy Guidelines requirements. However, validation data and results of analyses on at least five typical samples of the product are needed.

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table B

Product-Specific Data Requirements for Methomyl Manufacturing-Use Products

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Product Chemistry (cont.)						
163.61-8(c)(8)	Density or Specific Gravity	Yes	Each MUP	Partial	—	Yes: 6 months[1/]
163.61-8(c)(11)	pH	Yes	Each MUP	No	—	Yes: 6 months[1/]
163.61-8(c)(12)	Storage Stability	Yes	Each MUP	No	—	Yes: 6 months[1/]
163.61-8(c)(13)	Flammability	Yes	MUP	Partial	—	Yes: 6 months[1/]
163.61-8(c)(14)	Oxidizing or Reducing Action	Yes	MUP	No	—	Yes: 6 months[1/]
163.61-8(c)(15)	Explosiveness	Yes	MUP	No	—	Yes: 6 months[1/]
163.61-8(c)(16)	Miscibility	Yes	MUP	No	—	Yes: 6 months[1/]
163.61-8(c)(17)	Viscosity	Yes	MUP	No	—	Yes: 6 months[1/]
163.61-8(c)(18)	Corrosion Characteristics	Yes	MUP	No	—	Yes: 6 months[1/]

[1/] These requirements must be fulfilled by each applicant. Data from other applicants may not be cited. Therefore, even if the requirements have been partially or completely filled for some products, no references are given. These requirements must be filled at the time of registration or reregistration.

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table B

Product-Specific Data Requirements for Manufacturing-Use Products

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Toxicology						
163.81-1	Acute Oral Toxicity	Yes*	MUP	No	—	Yes: 6 months
163.81-2	Acute Dermal Toxicity	Yes*	MUP	No	—	Yes: 6 months
163.81-3	Acute Inhalation Toxicity	Yes	MUP	Yes	Hornberger, 1967, 00008980	No
163.81-4	Primary Eye Irritation	Yes	MUP	No	—	Yes: 6 months
163.81-5	Primary Dermal Irritation	Yes	MUP	No	—	Yes: 6 months
163.81-6	Dermal Sensitization	Yes	MUP	No	—	Yes: 6 months

* These requirements may be filled by data required in Table 1 entitled: "Generic Data Requirements" for manufacturing-use products determined to be substantially similar to the technical products.

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table C

Product-Specific Data Requirements for Methomyl End-Use Products

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Product Chemistry						
163.61-3	Product Identity and Disclosure of Ingredients	Yes	Each product	Yes		Yes: 6 months 1/
163.61-4	Description of Manufacturing Process	Yes	Each product	No		Yes: 6 months 1/
163.61-5	Discussion of Formation of Unint. Ingredients	Yes	Each product	No		Yes: 6 months 1/
163.61-6	Declaration and Certification of Ingredient Limits	Yes	Each product	No		Yes: 6 months 1/
163.61-7	Product Analytical	Yes	Each product	No		Yes: 6 months 1/
163.61-8(c)(1)	Color	Yes	Each product	No		Yes: 6 months 1/
163.61-8(c)(2)	Odor	Yes	Each product	No		Yes: 6 months 1/
163.61-8(c)(7)	Physical State	Yes	Each product	Yes		Yes: 6 months 1/
163.61-8(c)(8)	Density of Specific Gravity	Yes	Each product	Partial		Yes: 6 months 1/

1/ These requirements must be fulfilled by each applicant. Data from other applicants may not be cited. Therefore, even if the requirements have been partially or completely filled for some products, no references are given. These requirements must be filled at the time of registration or reregistration.

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table C

Product-Specific Data Requirements for Methomyl End-Use Products

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Product Chemistry						
163.61-8(c)(11)	pH	Yes	Each product	No	—	Yes: 6 months[1/]
163.61-8(c)(12)	Storage Stability	Yes	Each product	No	—	Yes: 6 months[1/]
163.61-8(c)(13)	Flammability	Yes	Each product	Partial	—	Yes: 6 months[1/]
163.61-8(c)(14)	Oxidizing or Reducing Action	Yes	Each product	No	—	Yes: 6 months[1/].
163.61-8(c)(15)	Explosiveness	Yes	Each product	No	—	Yes: 6 months[1/]
163.61-8(c)(16)	Miscibility	Yes	Each product	No	—	Yes: 6 months[1/]
163.61-8(c)(17)	Viscosity	Yes	Each product	No	—	Yes: 6 month[1/]
163.61-8(c)(18)	Corrosion Characteristics	Yes	Each product	No	—	Yes: 6 months[1/]

[1/] These requirements must be fulfilled by each applicant. Data from other applicants may not be cited. Therefore, even if the requirements have been partially or completely filled for some products, no references are given. These requirements must be filled at the time or registration or reregistration.

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table C

Product-Specific Data Requirements for End-Use Products

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Toxicology: Formulation Intermediate						
163.81-1	Acute Oral Toxicity	Yes	Each product	Yes[1/]	Barbo, 1972, 00007775	No
163.81-2	Acute Dermal Toxicity	Yes	Each product	Partial	Dashiell, 1971, 00007974	Yes: 6 months[2/]
163.81-3	Acute Inhalation Toxicity	Yes	Each product	Yes	Hornberger, 1967, 00008980 Brown, 1973, 00007774	No[3/]
163.81-4	Primary Eye Irritation	Yes	Each product	No	-	Yes: 6 months
163.81-5	Primary Dermal Irritation	Yes	Each product	No	-	Yes: 6 months
163.81-6	Dermal Sensitization	Yes	Each product	No[4/]	-	No

1/ The testing on the 90% and 24-31% soluble concentrate formulations fulfill the acute oral toxicity requirement for the 90% and 26% formulation intermediate products.

2/ Acute dermal toxicity testing is required on the 26% formulation intermediate product.

3/ Testing on the soluble concentrate formulations will fulfill the acute inhalation toxicity testing for the formulation intermediate products.

4/ Dermal sensitization testing on technical grade methomyl will fulfill this requirement for the formulation intermediates.

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table C

Product-Specific Data Requirements for End-Use Products

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Toxicology:	Soluble Concentrate					
163.81-1	Acute Oral Toxicity	Yes	Each product	Yes	Barbo, 1972, 00007775	No
163.81-2	Acute Dermal Toxicity	Yes	Each product	Partial	Bashiell, 1971, 00007974	Yes: 6 months 5/
163.81-3	Acute Inhalation Toxicity	Yes	Each product	Yes	Hornberger, 1967, 00008980 Brown, 1973, 00007774	No
163.81-4	Primary Eye Irritation	Yes	Each product	No	-	Yes: 6 months
163.81-5	Primary Dermal Irritation	Yes	Each product	No	-	Yes: 6 months
163.81-6	Dermal Sensitization	Yes	Each product	No 6/	-	No

5/ Testing must be submitted for soluble concentrate formulations containing 24-34 % methomyl.
6/ Dermal sensitization testing on technical grade methomyl will fulfill this requirement for soluble concentrate formulations.

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table C

Product-Specific Data Requirements for End-Use Products

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Toxicology: Granular						
163.81-1	Acute Oral Toxicity	Yes	Each product	Partial	Carroll, 1971 00008963	Yes: 6 months[7]
163.81-2	Acute Dermal Toxicity	Yes	Each product	Yes	Dashiell, 1971, 00007974; Knapp and Doyle, 1979, 00009067	No
163.81-3	Acute Inhalation Toxicity	Yes	Each product	Partial	Fabian and Taylor, 1979, 00009065	Yes: 6 months[7]
163.81-4	Primary Eye Irritation	Yes	Each product	Partial	Knapp and Doyle, 00009066	Yes: 6 months[7]
163.81-5	Primary Dermal Irritation	Yes	Each product	Yes	Knapp and Doyle, 1979, 00009068	No
163.81-6	Dermal Sensitization	Yes	Each product	No[8]	-	No

7/ Acute toxicity testing must be submitted for granular formulations containing greater than 2.5% methomyl.
8/ Dermal sensitization testing on technical grade methomyl will fulfill this requirement for granular formulations .

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table C

Product-Specific Data Requirements for End-Use Products

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Toxicology: Dust						
163.81-1	Acute Oral Toxicity	Yes	Each product	Yes	Carroll, 1971 00008963	No
163.81-2	Acute Dermal Toxicity	Yes	Each product	Yes	Dashiell, 1971, 00007974; Knapp and Doyle, 1979, 00009067	No
163.81-3	Acute Inhalation Toxicity	Yes	Each product	No	-	Yes: 6 months
163.81-4	Primary Eye Irritation	Yes	Each product	No	-	Yes: 6 months
163.81-5	Primary Dermal Irritation	Yes	Each product	Yes	Knapp and Doyle, 1979, 00009068	No
163.81-6	Dermal Sensitization	Yes	Each product	No[9/]	-	No

[9/] Dermal sensitization testing on technical grade methomyl will fulfill this requirement for dust formulations.

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

Table C

Product-Specific Data Requirements for End-Use Products

Guidelines Citation	Name of Test	Are Data Required?	Composition	Does EPA Have Data to Partially or totally Satisfy this Requirement?	Bibliographic Citation	Must Additional Data be Submitted under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Efficacy						
Housefly (Adult)	Animal Buildings and Outdoor Areas	Yes	1% Granular (0.5 lb. AI/ 1000 sq. ft.)	Yes	Berg, 1975, 00007012	No
Housefly (Adult)	Non-Food Areas of Food, Poultry and Meat Processing Plants, and Outside Livestock Holding Pens or Loading and Unloading Docks	Yes	1% Granular (0.25 lb. AI/ 1000 sq. ft.)	Yes	Berg, 1975, 00007012	No

These data requirements are current as of October, 1981. Refer to guidance package for updated requirements.

CHAPTER IV

Product Chemistry of Methomyl

INTRODUCTION

FIFRA 3(c)(2)(A) requires the Agency to establish guidelines for registering pesticides in the United States. The EPA requires registrants to provide quantitative data on all active and added inert ingredients, and on those impurities, which are equal to or greater than 0.1% of the product by weight.

To evaluate the composition of products proposed for registration, the Agency requires data and information not only on the manufacturing and formulation processes but also a discussion on the formation of manufacturing impurities and other product ingredients, intentional and unintentional. Further, to assure that the composition of the product as marketed will not vary from the composition evaluated at the time of registration, applicants are required to submit a statement certifying upper and lower composition limits for the added ingredients, and upper limits for some unintentional ingredients. Subpart D of the Proposed Guidelines (43 FR 29696, July 10, 1978) suggests specific precision limits for ingredients based on the percentage of ingredient and the standard deviation of the analytical method.

In addition to the data on product composition, the Agency guidelines also require data on the physical and chemical properties of both the pesticide active ingredient and formulations. For example, data are needed concerning the identity and physical state of the active ingredient such as melting and boiling point data, ambient vapor pressure and solubility. Data are also required on the properties of the formulated product to establish labeling precautions (e.g., flammability, corrosiveness, or storage stability). The Agency uses these data to characterize each pesticide and to determine its environmental and health hazards.

Product Chemistry: Manufacturing-use Methomyl

Product Chemistry Profile

Methomyl is the common name for the chemical S-methyl N-[(methylcarbamoyl) oxy] thioacetimidate. Methomyl is also known by the trade names Lannate^R and Nudrin^R.

Technical methomyl is a white, crystalline solid with a slight sulfurous odor and a melting point ranging between 77°-80°C. Methomyl decomposes slowly in water, the rate of degradation increasing with heat, alkalinity, aeration, and sunlight.

There are four currently registered manufacturing-use products of which two are technical methomyl products (98% and 95% methomyl) and two are formulation intermediate products (90% and 26% methomyl).

Descriptions of the manufacturing process for technical methomyl have been submitted to the Agency by two producers, but are inadequate.

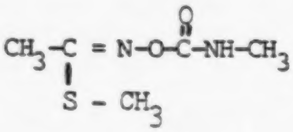
The manufacturing impurities which are present in methomyl have not been reported in sufficient detail. The confidential statements of ingredients for formulated products used on food or feed indicate that, with the exception of two ingredients, the inert ingredients are cleared under 40 CFR 180.1001. These two ingredients are listed in the Confidential Appendix to this Standard.

Product Chemistry Topical Discussions

Chemical Identity

The Agency requires identifying information including chemical names, product names, and numerical codes of all substances known or assumed to be present in pesticide products.

Methomyl is the common name accepted by the American National Standards Institute (ANSI) for the chemical S-methyl N-[(methylcarbamoyl)oxy]-thioacetimidate. The empirical formula is $C_5H_{10}N_2O_2S$ and the structural formula is:



$$CH_3-\underset{\underset{\displaystyle S-CH_3}{|}}{C}=N-O-\overset{\overset{\displaystyle O}{\|}}{C}-NH-CH_3$$

Alternative chemical names for methomyl include: methyl N-[[(methylamino)-carbonyl]oxy]ethanimidothioate, 1-(methylthio)ethylideneamino methylcarbamate, 1-(methylthio)acetaldehyde O-methylcarbamoyloxime. Methomyl is also known by the trade names Lannate^{R} and Nudrin^{R}. The Chemical Abstracts Registry number for methomyl is 16752-77-5, the duPont internal code number is 1179, and the EPA Shaughnessy number is 090301. The common name, methomyl, will be used throughout this Standard in lieu of other chemical or trade names.

Manufacturing Processes

Processes for the manufacture of methomyl have been submitted to the Agency by the two producers of technical methomyl, E.I. duPont de Nemours, Inc. and Shell. (E. I. duPont de Nemours, 1973, 00008625; Shell, 1973, GS-0028-0019). The manufacturing processes and the identification of impurities are discussed in the Confidential Appendix to this Standard.

The process descriptions submitted by the producers are not sufficiently detailed to satisfy Agency requirements.

Formation of Unintentional Ingredients

A discussion of the formation of unintended substances has not been submitted for any methomyl-containing product, and, therefore, a data gap exists for all products.

The manufacturing processes (E.I. duPont de Nemours, 1973, 00008625; Shell, 1973, GS-028-0019) for technical methomyl are unlikely to result in the formation of nitrosamines. However, the possibility exists that nitrosation of the methylcarbamoyl group of methomyl will occur during storage if nitrosating agents are added during formulation. Registrants must submit the results of analyses of methomyl products for nitrosomethomyl, or alternatively, a certification that nitrosating agents are not added to methomyl products.

Active Ingredient Limits in Pesticide Products

The percentages of methomyl in currently registered products are as follows:

Technical Methomyl	95%,98%
Formulation Intermediates	26%,90%
Formulations	
Soluble Concentrate - solid	90%
Soluble Concentrate - liquid	24%-31%
Dust	1.5%-2.5%
Granular	1%-5%

Upper and lower limits for the active ingredient have not been established and certified for any methomyl product.

Product Analytical Methods and Data

A liquid chromatographic method for the analysis of methomyl in formulations has been submitted to the Agency. Samples are extracted with warm ethanol-water (50:50) on a sintered filtering funnel. Ethanol is evaporated from the filtrate and the remaining aqueous material is extracted with chloroform. The chloroform extract is evaporated to dryness, the residue dissolved in tetrahydrofuran, and an internal standard (acetanilide) added to the solution. Aliquots of the solution are analyzed by liquid chromatography on a column equipped with a UV detector. Methomyl concentration is determined from a standard curve. The method standard deviation is claimed to be 0.6% (Leitch and Pease, 1973, 05012673). Although clearly intended for analysis of solid formulations, the method should also be useful for analysis of liquid products soluble in tetrahydrofuran.

Another liquid chromatographic method similar to the method above is available for product analysis. Samples are combined with an internal standard and shaken with chloroform for several hours. After the mixture settles, a portion of the supernatant liquid is diluted with methanol. The methanol solution is filtered, and an aliquot of the filtrate is analyzed by liquid chromatography. Methomyl is detected by its UV absorption at 254 nm and quantitated by comparison of the sample peak area with peak areas of standard methomyl and the internal standard. Technical methomyl is determined by dissolving it and the internal standard directly in methanol, and processing the methanol solution as described above (Rossol and Baxter, 1977, 00007014).

The methomyl assay methods discussed above satisfy Guidelines requirements. However, accompanying validation data and results of analyses on at least five typical samples of the product must be submitted.

The following spectral data has also been either published or submitted for methomyl: NMR (Alford and Keith, 1971, 05014578); infrared (Harvey and Buchanan, 1967?, 00008836;) and mass spectra (Harvey, 1964?, 00008845).

Physical and Chemical Properties

For every pesticide product, the Agency requires data on certain physical and chemical properties useful for identification purposes or for evaluation of hazard potential.

The physical and chemical properties of the two currently registered technical grade methomyl products have been reported (Shell, 1975, 05012838; duPont, 1977, 00008553) and are in Table 1 of this Chapter.

Table 1

Physical and Chemical Properties of Technical Methomyl Products

Property		Technical Product (EPA Reg. No.)	
		98% Methomyl (201-353)	95% Methomyl (352-366)
Color:		white	white
Odor:		slight sulfurous	slight sulfurous
Melting point:		77-80°	78-79°C
Solubility:	water	4-6% at 23°C	water 5.8%
	isopropyl alcohol	15-20% at 20°C	methanol 100%
	N-methyl pyrollidone	50-60% at 20°C	acetone 73% ethanol 42%
	paraffin oil	0.01% at 20°C	iso-propanol 22%
	dimethyl sulfoxide	50-60% at 20°C	toluene 3%
Stability:	Thermal $t_{1/2}$	4 days at 120°C 12 days at 100°C 49 days at 90°C	Stable in solid form. Aqueous solutions in closed systems decomposed slowly;
	Hydrolytic $t_{1/2}$	21 hrs at pH 1 500 hrs at pH 7 140 hrs at pH 9 38-44 hrs at pH 9 3 hrs at pH 10 <<1 hr at pH 13	aeration, sunlight, alkalinity, and higher temperatures increase rate of decomposition in water.
	Photochemical (248-436 nm at 30°C in ethanol)	color change at 2 hrs 50% loss at 3 hrs 85% loss at 17 hrs	
Physical State:		crystalline solid	crystalline solid
Density or Specific:		34 lb/cu ft (loose) 45 lb/cu ft (packed)	1.2946 25°/4°C

Vapor Pressure: (mm Hg)	2.4×10^{-6} at 20°C 1.2×10^{-5} at 30°C 5.6×10^{-5} at 40°C	5×10^{-5} at 25°C 1.6×10^{-4} at 40°C

The following data are available for the registration of individual manufacturing-use products:

Manufacturing-Use Products
(EPA Reg. No.)

Property	98% Methomyl (201-353)	90% Methomyl (352-361)	26% Methomyl (352-365)	95% Methomyl (352-366)
Physical State:	crystalline solid	dust	liquid	crystalline solid
Density or Specific Gravity:	34 lb/ft^3 (loose) 45 lb/ft^3 (packed)	no data	0.89 gm/ml	1.2946 25°C/4°C
Flammability:	no data	no data	62°F T.O.C.	no data

Product Chemistry: End-use Formulations

Product Chemistry Profile

End-use methomyl products are available in liquid and solid soluble concentrates, granular and dust formulations. Methods for determination of the active ingredient in methomyl-containing products have been published, but analytical data on product samples have not been submitted. Little data are available on the physical/chemical properties of any end-use product.

Product Chemistry Topical Discussions

Chemical Identity

Methomyl end-use products are marketed under the trade names Lannate^R and Nudrin^R.

Physical and Chemical Properties

The following data are available on the physical and chemical properties for end-use methomyl products:

Density or Specific Gravity:

Product Name	Formulation Type	Density or Specific Gravity
Lannate^R 4-G Methomyl (EPA Reg. No. 352-363)	4% Granular	24 lb/ft^3

Lannate^{R}G Methomyl (EPA Reg. No. 352-364)	5% Granular	24 lb/ft^3
Purina Fly Patrol (EPA Reg. No. 602-260)	1% Granular	0.87 lb/gal
Triangle 2% Methomyl (EPA Reg. No. 1842-272)	2% Dust	29 lb/ft^3
2% Methomyl Insecticide (EPA Reg. No. 4185-521)	2% Dust	38.6 lb/ft^3
Methomyl Dust No. 1 (EPA Reg. No. 14775-9)	2% Dust	60 lb/ft^3

Flammability:

The flash point of Lannate L Methomyl Insecticide^R is 63°F T.O.C. (Shell, 1973, 00007042).

Chapter V

Environmental Fate of Methomyl

Use Profile

Methomyl is a broad-spectrum insecticide federally registered to control a a variety of insect pests, including many Lepidopteran larvae. It is estimated that 9-13 million pounds of the active ingredient are produced annually in the United States. Approximately 5-6 million pounds are exported, and the remainder is for domestic use.

Approximately 70-80 percent of the methomyl purchased annually in the United States is formulated into methomyl products that are used on soybeans, peanuts, cotton, and tobacco. Much of the remaining 20-30% is formulated into products that are used on a wide variety of vegetables including corn, tomatoes, lettuce, beans, sugar beets, and celery. A relatively small amount of methomyl products (less than 5%) is used on fruits (grapes, oranges, apples, melons, and strawberries) and ornamentals.

Methomyl is formulated predominantly into a 90% a.i. water soluble powder and a 1.8% and 2.4% a.i. liquid. Other registered formulations include dusts (1.5%-2.5% a.i.), granulars (1.0%-5.0%), and baits (1.0%-2.5% a.i.). All soluble concentrates not in water soluble bags and baits (except 1% fly bait) are restricted use pesticides registered for sale to and use only by certified applicators or persons under their direct supervision.

The liquid and solid soluble concentrates are diluted with water and for most crops are applied as a foliar treatment after insects first appear. Methomyl is applied with aircraft and ground equipment, including air-blast sprayers, hydraulic sprayers with a single wand (gun) or boom, and others. The type of equipment is determined by the site and equipment availability.

Environmental Fate Profile

The available data are not sufficient to completely assess the environmental fate of methomyl.

Methomyl degrades more rapidly in sandy loam and California soil than in silt loam soils, with 21%, 31% and 46% of the applied methomyl remaining in the respective soils 42-45 days after treatment. The major degradation product is CO_2, which accounts for 23-47% of the applied methomyl after 42-45 days. A possible hydrolysis product, S-methyl N-hydroxythioacetimidate, was also found. Methomyl half-lives are less than 30 days in sandy loam soils. In a sterile Flanagan silt loam soil 89% of the methomyl remains 45 days after application, thus indicating that methomyl degradation in soil is primarily a microbial process.

The nitrogen-fixing ability of Azotobacter vinelandii and a Rhizobium is not altered following treatment with methomyl at 5-250 ppm or 5-50 ppm, respectively. Populations of Anabraena cylindica are reduced by as much as 54% and nitrogen fixation is reduced by up to 85%, compared with controls, following treatment with methomyl at 20, 40, 80, or 160 ppm.

At 0.5 ppm methomyl moderately inhibited nitrification, up to 32%, in silt loam soil for 4 days; recovery occurred in 19 days. At 5.0 ppm nitrification is severely inhibited by as much as 82% for 4 days but recovers by 28 days after treatment. In another study methomyl (18 ppm) had no effect on fungal and bacterial populations in either silt loam or fine sand soils.

In a silt loam soil, 71% of the radioactivity and 98% of the methomyl dissipates within 1 month after treatment. Three months after treatment 90% of the radioactivity dissipates from a fine sand soil and by 5 months 85% dissipates from a loamy sand soil. No methomyl residues are detected in muck soil 7-32 days after treatment.

Based on the limited data available methomyl does not appear to present a persistence problem in soil and does not adversely affect the general soil microbial population. However, methomyl does severely inhibit nitrification for 4 days after treatment. Therefore, repeated applications of methomyl, which are allowed by the use pattern, within a 19 day period may result in a prolonged period of reduced nitrification.

Based on the low degradation rates in sterialized soil it appears that the main means of methomyl degradation is microbial metabolism to CO_2. The fact that a possible hydrolysis product was found would indicate that hydrolysis is at least a minor means of transformation.

Topical Discussions

Physico-Chemical Transformation

Hydrolysis

Hydrolysis data are required to support the registration of all manufacturing-use products regardless of the intended end uses of products formulated from the manufacturing-use product.

One hydrolysis study was reviewed and determined to be invalid. Therefore, no valid data on the hydrolysis of methomyl are available.

All studies specified in Section 163.62-7(b) of the Proposed Guidelines for Registering Pesticides are needed to assess the hydrolysis properties of manufacturing-use methomyl.

Photolysis

A photodegradation study in water is required to support the registration of each formulated end-use product intended for terrestrial (except greenhouse and domestic outdoor), aquatic, and forestry use and for any aquatic impact use which results in direct discharges into the aquatic environment. Such a study is also required to support the registration of each manufacturing-use product which legally could be used to make such an end-use product.

Photodegradation studies on soil surfaces are required to support the registration of each formulated end-use product intended for crop uses and forestry uses. Such studies are also required to support the registration of each manufacturing-use product which legally could be used to make such an end-use product.

Laboratory photodegradation studies in the vapor phase are required to support the registration of each formulated end-use product for greenhouse use. Such studies are also required to support the registration of each manufacturing-use product which legally could be used to make such an end-use product.

One photolysis study was reviewed but was determined to be invalid. No valid data are available on the photolysis of methomyl.

All data specified in Section 163.62-7(c) of the Proposed Guidelines for Registering Pesticides are needed to determine the effect of light on methomyl.

Metabolism

Data on metabolism are required to determine the nature and availability of pesticide residues to rotational crops and to help in the assessment of potential disposal and reentry hazards.

Soil Metabolism

An aerobic laboratory soil metabolism study is required to support the registration of all products intended for terrestrial end-uses, or terrestrial/aquatic (forest) end-uses. Such a study is also required to support the registration of each manufacturing-use product which legally could be used to make such an end-use product.

An anaerobic soil metabolism study is required to support the registration of each formulated end-use product intended for field or vegetable crop use. Such a study is also required to support the registration of each manufacturing-use product which legally could be used to make such an end-use product.

Five soil metabolism studies were reviewed and four were found to be valid.

Several studies on the metabolism of [^{14}C] methomyl in Keyport silt loam, Flanagan silt loam, sandy loam, muck, and a California soil are available (Harvey, 19??, 00009325; Harvey, 1964?, 00008844; Harvey, 1977, 00008567; Harvey, 1977, 00008568). Methomyl was degrades more rapidly in the sandy loam and California soils than in the silt loam soils, with 21%, 31% and 44-48% of the methomyl applied remaining in the respective soils 42-45 days after treatment. The major degradation product in silt loam, California and muck soils is CO_2 with 23-47% of the methomyl degraded to $^{14}CO_2$ in 42-45 days. A degradation product, S-methyl N-hydroxythioacetimidate, was also found. The half-lives of methomyl are 15-30 days in the sandy loam soil, less than 42 days in the California soil, and approximately 45 days in the muck and silt loam soils.

In sterile Flanagan silt loam soil treated with [^{14}C] methomyl, 89% of the radioactivity is present as methomyl and 8% is soil bound 45 days after treatment (Harvey, 1977, 00008568).

Data from these studies satisfy part of the data needed to assess the soil metabolism of methomyl by providing a half-life of methomyl in a silt loam soil. Additional data are needed.

Aquatic

No data on the aquatic metabolism of methomyl are available nor are data required on the aquatic metabolism of methomyl because the use pattern indicates that direct discharges into the aquatic environment is unlikely.

Microbial Metabolism

Data on the effects of microbes on pesticide degradation and the effects of pesticides on microbes are required to support the registration of each formulated end-use product intended for terrestrial (except greenhouse and domestic outdoor), aquatic, and forestry uses and for any aquatic impact use which results in direct discharges into the aquatic environment. These data are also required to support the registration of each manufacturing-use product which legally could be used to make such a formulated product.

Effects of Microbes on Pesticides

A study by Harvey (1977, 00008568) using sterile and nonsterile Flanagan silt loam soil treated with [^{14}C] methomyl and aerobically incubated for 45 days at 25°C shows that methomyl is degraded by soil microorganisms. At 45 days after treatment, 23% of the radioactivity in the nonsterile soil was recovered as $^{14}CO_2$, 47% recovered as methomyl, and 26% was soil bound. In the sterile soil, 89% of the radioactivity is recovered as methomyl and 8% is soil bound.

This study provides some information on the rate of methomyl metabolism by soil microorganisms. The requirement for the submission of additional data is currently being reserved pending the review and modifications of the testing protocols.

Effects of Pesticides on Microbes

Four studies concerning the effects of methomyl on microbes were reviewed. Methomyl did not have a significant effect on the nitrogen-fixing ability of **Azotobacter vinelandii** ,after treatment with 90% analytical grade methomyl at 5, 50, or 250 ppm, or Rhizobium sp. after treatment with 90 wettable powder methomyl at 5 or 50 ppm , (Rodell et al.,1977, 05008720). When cultures of Anabaena cylindrica were treated with methomyl (formulation unspecified) at 20, 40, 80, or 160 ppm, the population is reduced by as much as 54% and nitrogen fixation is reduced by as much as 85% as compared with controls (Huang, 1978, 05010223).

Han (19??, 00009328) investigated the effect of methomyl on nitrification in a silt loam soil. When the soil is treated with methomyl (99% analytical grade) at 0.5 ppm, nitrification is reduced 32% as compared with controls four days after treatment but increases to control levels within 19 days. When the soil is treated with methomyl at 5.0 ppm, nitrification is reduced 82% as compared with controls at 4 days after treatment but increases to control levels within 28 days. A study on the effect of methomyl on soil bacteria and fungi in silt loam and fine sand soils is available (Peeples, 1977, 00008581). Methomyl (90 WD) at 18 ppm has no effect on fungal and bacterial populations in the soils tested and does not inhibit production of CO_2 by the soil microorganisms.

Methomyl does not inhibit nitrogen-fixing bacteria, soil fungal and bacterial populations, or CO_2 evolution by soil microorganisms. Methomyl at 20-160 ppm severely inhibits the nitrogen-fixing ability of the blue-green alga Anabaena cylindrica . At 0.5 ppm methomyl inhibited nitrification in soil for less than 19 days, and at 5.0 ppm nitrification was severely inhibited by 33-82% for less than 28 days.

These studies provide some information on the effect of methomyl on nitrogen fixation, nitrification, CO_2 evolution, and soil fungal and bacterial populations. The requirement for the submission of additional data is currently being reserved pending the review and modification of testing protocols.

Activated Sludge

A laboratory study of the effects of pesticides on the wastewater treatment process is required to support the registration of all manufacturing-use chemicals and all formulated products that are indirectly discharged into wastewater systems.

One study was reviewed and determined to be invalid. No data are available on the activated sludge metabolism of manufacturing-use methomyl.

The requirement for the submission of activated sludge data is currently being reserved pending the development of acceptable test protocols.

Mobility

Leaching

Leaching data are required to support the registration of products intended for the following end-uses: domestic, outdoor use, greenhouse use, terrestrial noncrop use, orchard crop use, field or vegetable crop use, forestry use, aquatic use, and aquatic impact use involving direct discharge. Such data are also required to support the registration of each manufacturing-use product which legally could be used to make such an end-use product.

One leaching study was reviewed and determined to be invalid. No leaching data for methomyl are available. All data specified in Section 163.62-9(b) of the Proposed Guidelines for Registering Pesticides (July, 1978). For terrestrial noncrop uses, orchard crop uses, field-vegetable crop uses, and forestry uses, the mobility of test substance and its degradates in soil shall be assessed either by soil thin layer chromatography, soil column, or batch equilibrium (adsorption/desorption) procedures.

Volatility

Laboratory volatility studies using non-radioisotopic analytical techniques are required to support the registration of all products intended for greenhouse use and to evaluate reentry hazards from cholinesterase-inhibiting pesticides.

No data on the volatility of methomyl are available. Methomyl is a cholinesterase inhibiting pesticide and the possibility of a reentry hazard exists with current uses of methomyl. Consequently, all data specified in Section 163.69(c) are needed to determine the volatility of methomyl.

Adsorption/Desorption

A laboratory study using radioisotopic or non-radioisotopic analytical techniques is required to support the registration of all products intended for terrestrial end uses, terrestrial/aquatic (forest) end uses, aquatic end uses, and aquatic impact uses.

One study was reviewed and determined to be invalid. No data are available on the adsorption/desorption of methomyl. All data specified in Section 163.62-9(d) of the Proposed Guidelines for Registering Pesticides are needed to evaluate the adsorption/desorption of methomyl. For domestic outdoor uses, greenhouses uses, aquatic uses, and aquatic impact uses, the mobility of the test substance and its degradates in soil shall be assessed only by the batch equilibrium (adsorption/desorption) procedure.

Water Dispersal

No data on the water dispersal of methomyl are available nor are any data on the dispersal of methomyl required because the use pattern indicates that a direct discharge in the aquatic environment would not occur.

Field Dissipation

Field dissipation studies under actual use conditions are required to support the registration of all products intended for terrestrial (except greenhouse) end uses, aquatic end uses, and terrestrial/aquatic (forest) end uses.

Terrestrial

Three field dissipation studies, using an unspecified formulation of methomyl, were reviewed. Two studies (Harvey, 1964?, 00008844; Harvey and Pease, 1971?, 00009324) were available on the dissipation of [^{14}C] methomyl in silt loam, fine sand, and loamy sand soils. One month after treatment, 71% of the radioactivity and 98% of the methomyl dissipated from the silt loam soil. One year after treatment, methomyl residues could not be detected. Three months after treatment 90% of the radioactivity dissipated from the loamy sand. A runoff study using a sandy soil shows that no detectable methomyl residues are found in soil samples collected from an area downhill from treated plots or in water samples collected from gutters located below untreated plots up to 15 days after treatment with methomyl (Harvey and Pease, 1971?, 00009324). A third study (duPont, 1971, 00009326) reported no detectable methomyl residues (0.02 ppm) in a muck soil 7-32 days after treatment.

From the results of the available data, methomyl appears to dissipate rapidly, with at least 85% of the residues dissipating within 5-months after treatment.

Additional data are needed to determine the terrestrial dissipation rate of methomyl formulations in the use areas listed below. Testing on one product within a formulation category will be acceptable.

- Field and vegetable crop uses:
  - Dusts - 2.0 and 2.5% ai
  - Granular - 1.25, 1.5, 2.0, 4.0, and 5.0% ai
  - Soluble concentrate/liquid - 1.8 and 2.4 lb ai/gal
  - Soluble concentrate/solid - 90% ai
- Tree fruit and nut crop uses:
  - Granular - 1.25%
  - Soluble concentrate/liquid - 1.8 lb ai/gal
  - Soluble concentrate/solid - 90% ai
- Domestic outdoor, parks, ornamental, and turf uses:
  - Granular - 1.25%
  - Soluble concentrate/liquid - 1.8 and 2.4 lb ai/gal
  - Soluble concentrate/solid - 90% ai

Aquatic

No data are available on the aquatic dissipation of methomyl. Data on the aquatic dissipation of methomyl are not required because the use pattern indicates that introduction of methomyl into the aquatic environment would not occur.

Forestry

Forest dissipation studies are required to support the registration of all products intended for forest end-use. No data are available on the dissipation of methomyl in forests. Data are needed for the the following formulations:

Soluble concentrate/liquid - 1.8lb ai/gal
Soluble concentrate/solid - 90% ai

Aquatic Impact Uses

No data are required under this topic for methomyl. No additional data are required.

Combinations and Rank Mixes

No data on the dissipation of multiple active ingredient formulations of methomyl are available. Data requirements for combinations and tank mixes are not cited here because this registration standard deals only with products containing methomyl as a single active ingredient.

Accumulation

Rotational Crops

Accumulation studies in rotational crops are required to support the registration of each formulated end-use product intended for field/vegetable or aquatic food or feed crop use and for use on any site on which it is reasonable to assume that any food or feed crop may be produced after application of a pesticide.

No data on the accumulation of methomyl in rotational crops are available. All data specified in Section 163.62-11(b) of the Proposed Guidelines for Registering Pesticides are needed to determine whether methomyl will accumulate in rotational crops.

Irrigated Crops

No data are available on the accumulation of methomyl in irrigated crops nor are data required because the use pattern indicates that methomyl would not be used on irrigated crops.

Fish

A laboratory study employing radioisotopic or non-radioisotopic analytical techniques is required to support the registrations of all formulated products intended for outdoor impact use (except domestic outdoor), or aquatic impact uses resulting in direct discharge into aquatic environments and for each manufacturing-use product that could be legally used to produce such a product. These data are not required if the registrant can offer evidence that the applied pesticide and one of its principal degradation product(s):

1. will not reach water, or will not persist in water (i.e., a nominal half life of four days or less); and
2. has physical properties suggesting a relatively low potential for accumulation (i.e., a nominal octanol/water partition coefficient less than 1000); and
3. does not accumulate in the organs and tissues of animals or avian species.

The Agency may consider the particular use pattern and the rate and frequency of application in making a decision to waive or maintain the data requirement (such as in cases where movement to water is obviously neglible or where frequent application counteracts a fast dissipation rate).

No data on the accumulation of methomyl in fish are available. All data specified in Section 162.11(d) of the Proposed Guidelines for Registering Pesticides are needed to evaluate the potential of methomyl to accumulate in fish.

Reentry

Reentry intervals are required to support the registration of all products for which the Agency has determined that a reentry hazard exists for persons reentering treated sites. Methomyl is an acetylcholinesterase inhibiting pesticide which presents a hazard to persons reentering treated fields.

Three studies concerning reentry intervals for methomyl were reviewed and all were considered valid. The results of one study showed that a methomyl dust formulation is far more persistent on leaf surfaces than an aqueous solution of methomyl on cotton leaves (Bull, 1974, 05009351). An application of 50 ug/leaf of an aqueous solution of methomyl quickly penetrated cotton leaves; surface methomyl levels were less than 7% of the applied amount after 1 day and less that 2% after 2 days. However, after an application of a dust, methomyl levels on leaf surfaces were 86% and 81% of that applied after 1 and 2 days, respectively.

In another study, foliar applications of water soluble formulations at 0.5 lb ai/A were sprayed on beans, corn, and cabbage. Surface methomyl levels decreased 71%-93% in 12 hours (Pease, 1971?, 00007684).

Peppermint fields were sampled after aerial applications of methomyl in Oregon. In one study it was found that dislodgeable methomyl declined from 1.52 to 0.33 ug/cm^2 between 4 and 48 hours after an application of 0.9 lb ai/A. At 1.8 lb ai/A, dislodgeable methomyl declined from 2.30 to 0.63 ug/cm^2 over the same time interval.

For each crop the registrant must propose an acceptable reentry interval; this proposed interval may be based on any of the following: (a) the longest (most restrictive) existing reentry intervals; (b) data on dissipation of foliar residues (decline curve), on human exposure to those residues, and on the inherent toxicity of methomyl; (c) determination of that time beyond which there are no detectable foliar residues (under appropriate climatic conditions) in the area where methomyl will be applied.

The Agency is adopting the 2 day reentry interval established by the State of California for the use of methomyl on citrus, grapes, peaches, and nectarines (California Administrative Code, January 4, 1979, Article 23, 2479 (h), Field Worker Safety). Registrants have the option of accepting the 2 day reentry interval or of supplying exposure data, a dislodgeable residue decline curve and establishing an appropriate reentry interval based on this data.

Reentry data must be submitted for the use of methomyl on the following crops: alfalfa, apples, asparagus, beans, blueberries, broccoli, brussel sprouts, cabbage, carrots, cauliflower, celery, collards, corn, cotton, cucumbers, lettuce, melons, mint, onions, peanuts, peas, peppers, potatoes, sorghum, soybeans, summer squash, spinach, sugar beets, tobacco, tomatoes, forest trees, and ornamentals.

Formulations of Methomyl

Water-soluble powders (90% ai) and liquids (1.8 and 2.4 lb ai/gal) are the predominant formulations. Other registered formulations include dusts (1.25-2.5% ai), granulars (1-5% ai), and baits. The pesticide is applied as a foliar treatment with aircraft (fixed-wing and helicopters) and ground equipment, including airblast sprayers, and hydraulic sprayers with a single wand (gun) or boom. The specific type of equipment is determined by the site and equipment availability.

The use of airblast machines (which direct the spray upward) and aircraft increases the potential for exposure via spray drift to humans, livestock, or wildlife outside the application site. The potential for human exposure via ground water contamination cannot be assessed due to the lack of soil mobility data. Similarly, the absence of octanol water partition coefficients and bioassay data prevents an assessment of the bioaccumulation potential for methomyl.

One exposure study was reviewed and found to be valid. Respiratory exposure levels during mixing and loading operations using a closed-transfer system were nondetectable except on the occasion when a water-soluble packet of methomyl broke, which caused a high respiratory exposure level of 1,332 ug/m^3. Methomyl application with a rearmounted tractor boom resulted in respiratory exposure levels ranging from 0.0 to 7.5 ug/m^3 (Knaak et al., 1980, GS0028-0040).

A safe reentry interval of 2 days has been set in California for grapes, citrus, peaches, and nectarines . Data for corn, cabbage, and beans showed that foliar surface methomyl levels declined 71-93% within 12 hours after an application of water-soluble methomyl at 0.5 lb ai/A (Pease, 1971?, 00007684). On mint, dislodgeable foliar residues were 0.33 and 0.63 ug/cm^2, 48 hours after applicationx of 0.9 and 1.8 lb ai/A, respectively (Kiigemagi, 1979, 05018583). On cotton leaves it was shown that an aqueous solution of methomyl dissipated rapidly from leaf surfaces, whereas an application of a 5% dust dissipated much more slowly; (i.e., 81% of the applied methomyl remained on leaf surfaces 2 days after the dust application) (Bull, 1974, 05009351).

Water-soluble liquid formulations

The greatest potential for direct human exposure is during mixing and loading operations. Dermal and eye exposure from splashing of the concentrate can result during the mixing of the soluble liquid formulations.

Water-soluble powder and dust formulations

A potential for respiratory exposure from "puff back" during opening and mixing of these formulations can occur as notd in Knaak et al. when air contamination reached 1,332 ug/m^3 during an accident while water-soluble methomyl was being mixed.

Granular and bait formulations

Dermal exposure could occur while these formulations are being applied. However, such exposure could be greatly minimized by the use of gloves during application.

Chapter VI

Toxicology

Toxicology Profile; Manufacturing-use Methomyl

Acute Toxicity

Acute oral toxicity testing is available for technical grade methomyl. The oral LD_{50} in rats was determined to be 17 mg/kg for male rats and 23.5 mg/kg for female rats, corresponding to Toxicity Category I. Data on the soluble concentrate formulations fulfill this requirement for the formulation intermediate products. The 90% formulation intermediate corresponds to the 90% soluble concentrate (Toxicity Category I) and the 26% formulation intermediate corresponds to the 24-31% soluble concentrate (Toxicity Category II).

An acute dermal toxicity study is available on technical grade methomyl. A dose of 5000 mg/kg of 98.5% technical methomyl resulted in no observed toxic effects when applied to the intact skin of six male albino rabbits for 24 hours and then washed off. Based on these results, technical methomyl is assigned to Toxicity Category III. Data on the technical fulfills this requirement for the 90% formulation intermediate (Toxicity Category III). Testing on the 26% formulation intermediate is required.

Available acute inhalation toxicity data indicate that the LC_{50} value for technical methomyl is 0.45 mg/liter, corresponding to Toxicity Category II. Data on the soluble concentrate formulations fulfill this requirement for the formulation intermediate products.

No data are available to assess the primary eye, primary dermal irritation or dermal sensitization potential of technical grade methomyl or the formulation intermediate products.

An acute delayed neurotoxicity study is available on technical methomyl in hens. No evidence of leg or wing paralysis was noted and the pathological examination revealed no abnormalities. The test did not indicate any potential for methomyl causing delayed neurotoxicity.

Subchronic Toxicity

There are eight subchronic oral toxicity tests available on technical methomyl conducted on the rat, beagle dog, and cow. In one study done on rats, growth depression was noted at 125 ppm in males. In another study also on rats a NOEL of 400 ppm was shown for cholinesterase depression. Since chronic testing data are available, results from subchronic testing were not used to set a NOEL for methomyl.

A 21-day dermal toxicity study is available using a 90% soluble concentrate methomyl formulation. Methomyl was administered dermally to rabbits with intact or abraded skin at a dose of 200 mg/kg, 5 days a week, for three weeks. There were no toxic symptoms noted in the animals with intact skin. This information fulfills the requirement for a 21-day dermal toxicity study and justifies setting a NOEL of 200 mg/kg for dermal toxicity.

Chronic Toxicity

Chronic Feeding

A twenty-two month feeding study is available for technical methomyl. Rats were fed dietary levels of 0, 50, 100, 200, and 400 ppm methomyl. No adverse effects were found at the 50 or 100 ppm levels. In male and female rats, 400 ppm caused compound-related histopathological alterations in the kidneys. Compound-related histopathology was seen in the spleen of female rats receiving 200 and 400 ppm. No effects were observed at 100 ppm.

In a two year study beagle dogs were fed 0, 50, 100, 400, or 1000 ppm of methomyl in their diet. Dose-related histopathology was observed in the kidney and spleen of 400 ppm and 1000 ppm dogs and in the liver and bone marrow of the dogs in the 1000 ppm dose group. A NOEL of 100 ppm was established for the systemic effects mentioned above.

Oncogenicity

An acceptable oncogenicity study is available in rats. ChR-CD rats were fed dietary levels of 0, 50, 100, 200, and 400 ppm methomyl for 22 months. No compound-related oncogenic effect was found. A second oncogeniocity test is required in mice since methomyl is used on a wide variety of food crops.

Teratogenicity

An adequate teratogenicity study is available in the rat. Pregnant rats were fed a diet containing 0, 50, 100, or 400 ppm methomyl on gestation days 6 through 15. Methomyl was not found to be either embryotoxic or teratogenic. Testing in a second species is required (rabbit).

Reproduction

An adequate reproduction study is available. Methomyl fed to ChR-CD rats at dietary levels of 50 and 100 ppm for three generations caused no adverse effects and no gross or histologic evidence of compound-related congenital abnormalities were observed. The NOEL was established at 100 ppm.

Mutagenicity

Mutagenicity tests on methomyl were reviewed. Methomyl did not induce unscheduled DNA synthesis in human fibroblast cells and did not induce reversion to histidine independence in several strains of Salmonella typhimurium . Another study tested the potential of methomyl to induce morphological transformation in nude mice. Methomyl at 1.0 mg/100g body weight was reported to be negative in this test. Further mutagenicity testing is required.

Metabolism

Two metabolism studies for methomyl were reviewed. These studies indicate that exhalation is the principle route of methomyl excretion and that CO_2 and acetonitrile were exhaled. Some unidentified metabolites were excreted in the urine. Additional metabolism testing is not required.

Emergency Treatment

Available data indicate that atropine was found to be an antidote for methomyl in the rhesus monkey, rat, dog, and rabbit. Also, tetraethylammonium chloride was found to be antidotal in beagle dogs and mice.

Fieldworker Exposure

Several studies are available concerning the cholinesterase activity in pesticide workers exposed to methomyl. Workers involved in the aerial application of methomyl displayed depressed whole blood cholinesterase values up to 60% of normal.

In another study, blood cholinesterase activities of workers involved in mixing or aerially applying concentrate or liquid methomyl were measured. One worker showed whole blood cholinesterase activity to be 40% of normal activity 12 hours after exposure and 80% of normal 36 hours after exposure.

Four of five field workers had cholinesterase values below normal range after they were exposed for 6-8 hours to vine and tree crops sprayed with methomyl.

In another study, calculations were done to estimate a maximum inhalation hazard to workers. The concentration resulting from a 1.0 lb/acre methomyl treatment under "worst case" assumptions was 0.12 mg/liter.

Information indicates that risks from exposure to dilutions of methomyl are acceptable provided reentry intervals are adhered to and that safety precautions on labels are taken.

Accident Reports

During the period from 1966 to 1981, 562 accident reports involving human exposure to methomyl were reported to the Pesticide Incident Monitoring System (PIMS). Of the 562 incidents involving humans, 462 were related to human exposure during agricultural use of methomyl alone (252 incidents) or in combination with other active ingredients (210 incidents). Included in the 462 incidents involving humans, 85 accidents occurred during mixing and loading, 39 were related to equipment malfunction and 37 incidents were attributed to exposure during the ground spray application of methomyl. There were 62 incidents of unspecified human exposure. The remaining incidents of human exposure resulted from exposure to spray drift during aerial and ground application of methomyl formulations.

Topical Discussions: Manufacturing-use Methomyl

Acute Toxicity

Acute Oral Toxicity

The minimum data required for establishing the acute oral toxicity of manufacturing-use methomyl (LD_{50}) is one test on the technical chemical and on each manufacturing-use product, preferably using the laboratory rat.

An adequate acute oral toxicity study in rats is available for technical methomyl (Sherman, 1966, 00009227). Methomyl was administered to groups of ten male rats in doses of 15, 17, 21, and 26 mg/kg and to groups of ten female rats in doses of 17, 20, 23 mg/kg. The oral LD_{50} was 17 mg/kg for males with a 95% confidence interval of 14-20 mg/kg. In females the LD_{50} was 23.5 mg/kg with a 95% confidence interval of 22-25 mg/kg. These data are sufficient to fulfill the acute oral toxicity data requirement for acute oral testing on technical methomyl and assign the compound to Toxicity Category I, indicating a high potential oral toxicity.

Several other acute oral studies were also performed using technical methomyl. Rabbits given 30 mg/kg of methomyl orally experienced cyanosis, fasciculations, salivation, and constricted pupils followed by death (Sherman, 1968, 00007172). The animals did not die from this dose of methomyl when it was immediately followed by an intraperoniteal injection of 50 mg/kg of atropine sulfate.

Atropine sulfate also acted as an antidote to methomyl poisoning in beagle dogs given oral doses of 10 and 20 mg/kg of methomyl (Sherman, 1968, 00008620). Cholinesterase activity returned to normal levels within 24 hours. Tetraethylammonium chloride was also antidotal in beagles. Other evidence indicates that tetraethylammonium chloride (20 mg/kg) acted as an antidote to methomyl poisoning in mice given 100 mg/kg of methomyl orally (Andrews and Miskus, 1968, 05008158).

The LD_{50} for methomyl in hens was calculated to be 28 mg/kg (Krauss and Stala, 1967, 00008827).

Acute Dermal Toxicity

The minimum data required for establishing the acute dermal toxicity of manufacturing-use methomyl is one test on technical methomyl and on each manufacturing-use product, preferably using the albino rabbit.

Several acute dermal toxicity studies are available for technical methomyl. The results are summarized below:

Species	Sex (#/dose)	Single dermal dose range	Skin	Results	Reference
Rats	Male (10)	1000 mg/kg	Intact	No deaths occurred	Morrow, 1972, 00009330
Rabbits	? (4)	1000-1500 mg/kg	Intact	No deaths occurred	Majkut and Hood, 1966, 00008978
Rabbits	Male (6)	5000 mg/kg	Intact	No observed toxic effects	Dashiell, 1971, 00007947

The above information is sufficient to fulfill the acute dermal toxicity data requirement for acute dermal testing on technical methomyl and assign the compound to Toxicity Category III (Dashiell, 1071, 00007947).

Acute Inhalation Toxicity

The minimum testing required to establish the acute inhalation toxicity of manufacturing-use methomyl is one test on the technical grade and on each manufacturing-use product, preferably in the laboratory rat. This testing is required if technical methomyl causes a respirable vapor, or if 20% or more of the aerodynamic equivalent is composed of particles not larger than 10 microns.

Acute inhalation studies have been reported using vapor from technical methomyl (purity unspecified). In one study, no rats died during a 4-hour exposure to nominal concentrations of 0.044 and 0.036 mg/liter of methomyl. Clinical signs observed during exposure included mild dyspnea, exophthalmos, and slight lacrimation (Foster and Waritz, 1966, 00008979). In a second study, rats were exposed for 4 hours to a heated methomyl aerosol (methomyl maintained at 90-110°C, air stream at 100-130°C) at a nominal concentration of 0.30-0.56 mg/liter (Foster, 1966, 00008982). Severe pulmonary irritation and death were observed in some animals.

A third study using technical methomyl as a aqueous aerosol of respirable particles was done using male rats (6 rats/dose group). Exposures ranged from 0.13 -.95 mg/liter. The LC_{50} for a 4-hour exposure was 0.45 ± 0.06 mg/liter (active ingredient). Clinical signs observed during exposure included tremors, irregular breathing, salivation, lacrimation, and exophthalmos (Hornberger, 1967, 00008980). This information is sufficient to fulfill the acute inhalation toxicity data requirement on technical methomyl and assign the compound to Toxicity Category II.

Primary Eye Irritation

The minimum testing required to establish the irritability of manufacturing-use methomyl to the eye is one test on the manufacturing-use product, preferably using the albino rabbit.

Two studies have been reported using technical methomyl (purity unspecified). Methomyl, either as 10 mg of powder or 0.1 ml of a 10% solution in propylene glycol, instilled in the eye of a rabbit (one animal per treatment) resulted in mild conjunctivitis, injection of iritic blood vessels, and marked pupillary constriction on the day of treatment (Eddy, 1964, 00009224). In a second study, again using only two rabbits and the same doses as the first study described, results suggested that the test compound had mild and transient effects on the rabbit eye (Reinke, 1967, 00009225).

The available data are not sufficient to satisfy the data requirement for primary eye irritation. Testing is needed.

Primary Dermal Irritation

The minimum testing needed to establish the irritability of manufacturing-use product preferably using the albino rabbit.

A primary dermal irritation study is not required for each formulation that has a pH of 1-3 or 12-14; a test substance with a pH of 1-3 or 12-14 will be considered corrosive to the skin.

No data were available to assess the primary dermal irritation potential of technical methomyl. Testing is needed.

Dermal Sensitization

The minimum testing required to assess dermal sensitization for the manufacturing-use product is an intradermal test using the manufacturing-use product, preferably using the guinea pig.

No data were available to assess the dermal sensitization potential of technical methomyl. Testing is needed.

Acute Delayed Neurotoxicity

The minimum data requirement for acute delayed neurotoxicity is one test on the technical material in hens. An acute delayed neurotoxicity test is required for methomyl since it is expected to cause cholinesterase depression.

Technical methomyl as a 5% suspension in acetone and water (1:10 ratio) was administered orally to hens at doses of 28-200 mg/kg, both with and without atropine pretreatment (Krauss and Stala, 1967, 00008827). No evidence of leg or wing paralysis was noted. Pathological examination of the sciatic nerve from these hens revealed no abnormalities.

This study satisfies the data requirement for acute delayed neurotoxicity. No further testing is needed.

Subchronic Effects

Subchronic Oral Toxicity

The minimum testing needed is one test on technical grade methomyl in two mammalian species, preferably the rat and dog. The subchronic oral toxicity test is required if pesticidal use requires a tolerance or an exemption from a tolerance, requires the issuance of a food additive regulative, or is likely to result in repeated human exposure through the oral route. The subchronic oral toxicity is required for methomyl because it has food uses and requires tolerances.

There are eight subchronic oral toxicity tests on technical methomyl. The results of these studies are summarized in Table 1 of this Chapter.

Subchronic 21-Day Dermal Toxicity

The minimum data required for subchronic 21-day dermal toxicity is one test on technical methomyl, preferably in the albino rabbit.

A 90% soluble concentrate formulation of Lannate^R was administered dermally to rabbits with intact or abraded skin at a dose of 200 mg/kg, 5 days a week for 3 weeks (Busey, 1967, 00009234). There were no toxic symptoms noted in the animals with intact skin. Those rabbits with abraded skin displayed tremors, labored breathing, loss of reflexes, pupillary constriction, and hyperactivity immediately after application of the test substance.

Table 1
Summary of Subchronic Oral Toxicity Testing

Species	Sex (#/dose)	Dose Level Tested	Duration	Results	Reference
Rat	M-F (10)	0, 10, 50, 125 250 ppm 500 ppm	1-6 weeks 3 weeks 7-13 weeks	1. No toxic signs or mortality observed. 2. Growth significantly depressed in 125/500 ppm males. 3. Moderate erythroid hyperplasia in bone marrow observed microscopically in 250 ppm males. 4. No effect was observed at 50 ppm for weeks 1-6 and 500 ppm for weeks 7-13.	Paynter, 1966, 00007190
Rat	M-F (10)	200 mg/kg diet	12 weeks	1. Increase in relative weight of spleen (males) and kidneys (females). 2. Liver triglycertide increased and liver free fatty acid decreased in males. 3. Glucose-phosphate dehydrogenase and brain cholinesterase activities reduced in both sexes.	Lintal, et al., 1979, 05018063

Species	Sex (#/dose)	Dose Level Tested	Duration	Results	Reference
Rat			14 days	1. Showed higher rate of activity when compared to controls.	Bracy et al., 1979, 05020053
Rat		5.1 mg/kg diet	10 days	1. No mortality was produced. 2. Chewing, yawning motions and irritability observed.	Sherman 1964, 00009228
Rat	M-F (10)	0, 200, 400, 800 ppm	79 days	1. In 800 ppm group, cholinesterase depression decreased to 70% of pretreatment levels. Rats in 400 ppm showed slight depression of cholinesterase activity. 2. NOEL of 400 ppm for cholenesterase activity.	Singles, 1970, 00008624

Species	Sex (#/dose)	Dose Level Tested	Duration	Results	Reference
Rat	M (?)	1, 200 ppm	11 days	1. Significantly inhibited erythrocycle cholinesterase activity in male rats.	Singles and Barnes, 1970, 00008503
Beagle Dog	M-F (4)	0, 50, 100, 400 ppm 90% SC	3 months	1. No abnormal histopathology at sacrifice; no toxic symptoms during treatment.	Sherman, 1967, 00009010
Cows	2	2 and 20 ppm	30 days	1. No detectable residues were seen in milk and tissues; no gross pathological lesions were observed.	duPont, 1967, 00008832

This information satisifies the requirement for a 21-day dermal toxicity study and justifies setting a NOEL of 200 mg/kg for 21-day dermal testing.

Subchronic 90-day Dermal Toxicity

A subchronic 90-day dermal toxicity test is not required because methomyl is not intentionally applied to skin or result in significant human dermal exposure.

Subchronic Inhalation Toxicity

Testing is required if the results of the acute inhalation toxicity tests indicate that repeated exposure at a concentration that is likely to be toxic occurs under normal conditions of use.

The available acute inhalation studies and current use restrictions and label precautions do not indicate that inhalation exposure at toxic concentrations is likely to occur under normal conditions. Therefore, subchronic inhalation testing is not required.

Subchronic Neurotoxicity

A subchronic neurotoxicity is required if a pesticide has shown positive results in the acute delayed neurotoxicity test or induced irreversible neurological toxicty in mammalian speicies. A subchronic neurotoxicity test is not required for methomyl because the available acute neurotoxicity test produced negative results.

Chronic Effects

Chronic Feeding

The minimum data required for an assessment of the chronic toxicity of methomyl is one test on the technical material, preferably using the laboratory rat. Chronic testing is required for methomyl because of the use on food crops.

A twenty-two month feeding study is available. Rats were fed dietary levels of 0, 50, 100, 200, and 400 ppm methomyl (Busey, 1968, 00007092). No adverse effects were found at the 50 or 100 ppm levels. In male and female rats, 400 ppm caused compound-related histopathological alterations in the kidneys, characterized by vaculolation of tubular epithelial cells and hypertrophy of convoluted tubules. Also, in female rats an increase in incidence of protein in tubules and tubular dilation occurred.

Compound-related histopathology was seen in the spleen of female rats receiving 200 and 400 ppm. Also, an increase in incidence and severity of extramedullary hematopoesis was observed. The NOEL for this effect in the rat is set at 100 ppm.

In a two year study in beagle dogs, four males and four females per dose group, the animals were fed 0, 50, 100, 400, or 1000 ppm of methomyl in their diet (Busey, 1968, 00007091). Dose-related histopathology was observed in the kidney and spleen of 400 ppm and 1000 ppm dogs and in the liver and bone marrow of the dogs in the 1000 ppm dose group. A NOEL of 100 ppm was established.

No aditional chronic feeding testing is required.

Oncogenicity

The minimum data required to assess the potential oncogenic effects of methomyl is testing on the technical material in two mammalian species, preferably the rat and mouse. Oncogenicity testing is required for methomyl because of the use on food.

An acceptable oncogenicity study in rats is available. ChR-CD rats, 35 males and 35 females per dose group, were fed dietary levels of 0, 50, 100, 200, and 400 ppm methomyl for 22 weeks (Busey, 1968, 00007092). The neoplastic lesions in the high-level test rats was generally comparable with those in the control animals. No oncogenic effects related to methomyl were found.

This study is sufficient to fulfill the testing requirement in the rat. An oncogenicity study in mice is required.

Reproductive Testing

Teratogenicity

The minimum data required to assess the potential teratogenic effects of methomyl is testing in two mammalian species using the technical chemical.

A teratogenicity study conducted with rabbits was reviewed and determined to be inadequate.

Another study conducted with rats was available. Pregnant rats were fed a diet containing 0, 50, 100, or 400 ppm of methomyl (99% pure) on gestation days 6 through 15 (Rogers et al., 1978, 00008621). Maternal body weight in the 400 ppm group was significantly lower than control weight on gestation day 21. The lower body weight was associated with decreased food consumption. There was only a slight effect noted on feed consumption at the 100 ppm level. Methomyl was not found to be either embryotoxic or teratogenic.

Testing is required in a second species (rabbit).

Reproduction

The minimum data requirement for reproduction is testing in one mammalian species, preferably the laboratory rats, using the technical chemical and lasting for two generations.

Reproductive testing is required if pesticidal use requires a tolerance or an exemption from a tolerance, requires the issuance of a food additive regulation, or is likely to result in significant human exposure.

Reproductive testing is required for methomyl because certain uses (application to food crops) require a tolerance.

In a multiple generation study, (Kundzin, 1978, 00007093), methomyl was added to the diet of 1-month- old ChE-CD rats (female and male) for approximately 3 months at dosage levels of 0, 50, or 100 ppm (based on active ingredient). After completion of this initial feeding period, a reproduction study was conducted with 10 male and 20 female rats within each group in which F_{1A} and F_{1B} litters were cast. Ten male and 20 female weanling rats were selected from the F_{1B} litter in each group and continued on their respective diets for 3 months, at which time they were bred within groups to produce F_{2A} and F_{2B} litters. This procedure was followed with the F_{2B} litter to produce the F_{3A} and F_{3B} litters. Ten male and 10 female weanling rats from the F_{3B} litter from the control and each test group were subjected to a histopathologic evaluation following necropsy.

Methomyl fed to ChR-CD rats at dietary levels of 50 and 100 ppm for 3 generations caused no adverse effect on reproduction nor any gross or histologic evidence of compound-related congenital abnormalities. The NOEL was 0.01% or 100 ppm.

No additional reproduction testing is required.

Mutagenicity

Mutagenicity testing is required for methomyl because of the use of methomyl on food crops.

Although the mutagenicity testing requirements are not final, refer to the Agency's Proposed Guidelines (FR 43, No. 163, Tuesday, August 22, 1978) for information concerning the types of studies the Agency is considering. The following studies are representative and are likely to be required:

1. A mammalian *in vitro* point mutation test.
2. A sensitive sub-mammalian point mutation test (bacteria, fungi, insect).
3. A primary DNA damage test (i.e., sister chromatid exchange or unscheduled DNA synthesis).
4. A mammalian *in vitro* or *in vivo* cytogenetics test. If this suggests a positive result, a dominant lethal or heritable translocation test may be required.

Methomyl (99% pure) did not induce unscheduled DNA synthesis (UDS) in WI38 human fibroblast cells; did not induce reversion to histidine independence in *Salmonella typhimurium* strains TA1535, TA1537, and TA1538, or TA100, or tryptophan independence in *Escherichia coli* strain WP2 *uvrA*; and was not more toxic to a recombination repair-deficient strain of *Bacillus subtilis* or a DNA polymerase-deficient (pol A_1^-) strain of *E.coli* than to the corresponding wild-type strain (Simmon et al., 1977, 05009139).

A host-mediated transplacental assay was used to provide exposed fetal hamster cells for testing the potential of methomyl (technical) to induce morphological transformation, the ability to grow in soft agar and tumorigenicity in nude mice (Quarles et al., 1979, 05018267). Methomyl at 1.0 mg/100g body weight was reported negative in the assay (i.e. nontransforming).

Methomyl (technical) at 50 moles per plate, in the absence of metabolic activation, did not increase the number of revertants per plate in an assay with *S. typhimurium* strains TA1535, TA1537, TA1538, TA98 and TA100 (Blevins et al., 1977, 00008623). Only a single dose was tested and no metabolic activation system was used.

A mammalian *in vitro* point mutation test and a mammalian *in vitro* or *in vivo* cytogenetics test are required.

Metabolism

The minimum data requirement for metabolism is a single dose, using the analytically pure grade of the active ingredient in the radio-labeled form.

A metabolism study is required for methomyl because methomyl is applied to food crops and a chronic feeding study is required.

After oral administration of radio-labeled methomyl (99% pure) to three male rats, more than one-half of the radioactivity was eliminated within 24 hours in the approximate ratio of 1:2:1, $^{14}CO_2$: ^{14}C-acetonitrile: unidentified polar urinary metabolites (Harvey et al., 1973, 05008198). Methomyl, S-methomyl N-hydroxythioacetimidate, methomyl S-oxide, and methomyl S,S-dioxide (or conjugates) were not detected in urine by countercurrent distribution, enzymatic treatment, or thin-layer chromatograph techniques.

In a study by Huhtanen and Dorough (1976, 05008202), syn-methomyl (Lannate pesticide) was metabolized differently by the rat than the less stable anti-methomyl. The syn-isomer gave rise to an oxcime that was metabolized primarily to CO_2, while the anti-isomer produced primarily acetonitrile. It was shown that the syn-isomer was partially isomerized to the anti-configuration in the rat prior to hydrolysis of the ester linkage. This conversion was related to the formation of acetonitrile.

In general, the above studies when considered together indicate that exhalation is the principle route of methomyl excretion and that CO_2 and acetonitrile were exhaled. Also, some unidentified metabolites were excreted in the urine. According to Harvey et al. the ratios between the above three were approximately 1:2:1 in the rat and over half the radioactivity was excreted in 24 hours. In addition 10 to 15 % of the radioactivity was retained longer than three days.

Additional testing on the metabolism of methomyl is not required.

Emergency Treatment

Atropine has been shown to be antidote for methomyl in the follwoing species:

Rhesus monkey (Teeters, 1968, 00008506)
Rat (duPont, 1972, 00009233)
Dog (Sherman, 1968, 00008620)
Rabbit (Sherman, 1968, 00007172)

Also, tetraethanolammonium chloride was found to be antidotal in beagle dogs and mice (Sherman, 1968, 00008620; Andrews and Miskus, 1968, 05008158).

Field Worker Exposure

Several studies are available concerning the cholinesterase activity in pesticide workers exposed to methomyl. Some workers (number unspecified) involved in the aerial application of methomyl (formulation unspecified) displayed depressed (up to 60% of normal) whole blood cholinesterase values (Simpson and Penney, 1974, 05008215).

In a separate study, whole blood, plasma, and red cell cholinesterase activities of workers who either mixed or aerially applied powdered concentrate or liquid methomyl formulations were determined (Simpson and Bermingham, 1977, 05008724). In one individual who handled the powdered concentrate whole blood cholinesterase activity was 40% of normal at 12 hours after exposure and 80% of normal at 36 hours after exposure. Little could be concluded concerning the amount of exposure that can be toxic in adults, since the specific formulations and exposure levels were not given.

Plasma and RBC cholinesterase activities were determined in five workers immediately after a weekly 6-8 hour exposure to vine and tree crops that had been sprayed with methomyl (1.8 lb/gal soluble concentrate) (duPont, 19??, 00009190). Four of five exposed workers had cholinesterase values below the normal range after being exposed to the pesticide, but no clinical symptoms of cholinesterase inhibition were reported.

In an experiment designed to obtain information relative to the establishment of reentry intervals for tobacco workers, groups of mice were exposed, for 10 hours, to tobacco leaves gathered at various times after field application of methomyl, at 1/2 lb per acre (Guthrie et al., 1974, 05013771). residues found in leaves and cholinesterase relationships were the following:

	0.25 hr	24 hr	48 hr
Residue (ppm)	137	58	33
ChE % inhibition RBC	56	27	1
ChE % inhibition plasma	36	12	1
Rainfall (inches)	0	0.05	-

Two series of calculations were reported describing the maximum amount of methomyl that could bo into the atmosphere as a vapor, using the ideal gas equation and the known methomyl vapor pressure of 1.6×10^{-4} mm Hg at 40°C, and the maximum inhalation hazard to workers, assuming an application of methomyl of 1.0 lb/acre with 100% of the methomyl becoming airborne throughout a volume 3 feet above the acre (duPont, 19??, 00009188). Based on the first set of calculations, the maximum methomyl vapor concentration was determined to be 0.00132 mg/liter. The concentration resulting from a 1.0 lb/acre methomyl treatment under the stated "worst case" assumptions was 0.12 mg/liter.

Available information indicates that risks from exposure to use dilutions of methomyl pesticides are acceptable provided reentry intervals are adhered to and safety precautions on labels are taken.

Accident Reports

The files of the Pesticide Incident Monitoring System (PIMS) were searched for reports involving methomyl, active ingredient S-methyl-N-[(methylcarbamoyl)oxy] thioacetimidate, also known by the trade names Lannate^{R} and Nudrin^{R}. The files contain 562 accident reports involving human exposure to methomyl from the period 1966 to 1981. The incidents considered in this review include only those which have been reported to PIMS and should be thought of as representing a minimum.

Of the 562 incidents involving humans, 462 were related to human exposure during agricultural use of methomyl alone (252 incidents) or in combination with other active ingredients (210 incidents). Included in the 462 incidents involving humans, 85 accidents occurring during mixing and loading, 39 were related to equipment malfunction, and 37 incidents were attributed to exposure during the ground spray application of methomyl. There were 62 incidents of unspecified human exposure. The remaining incidents of human exposure resulted from exposure to spray drift during aerial and ground application of methomyl formulations.

During the period from 1966 to 1981 three fatalities have been reported from the accidental ingestion of methomyl. These incidents of ingestion were not related to the pesticidal use of methomyl.

On February 9, 1978 the Agency published in the Federal Register (Volume 43, No. 28) a final rule to amend the regulation by adding section 162.31, Pesticide Use Classification, which lists uses of certain pesticides the Agency has classified as restricted. All registered methomyl uses of the concentrated solutions and 90% wettable powder formulations not in water soluble bags were classified for restricted use.

B. Soluble Concentrate Methomyl

Soluble Concentrate Methomyl: Toxicology Profile

Acute oral toxicity data are available for the 90% and 24% soluble concentrate methomyl formulations. An LD_{50} value of 18 mg/kg was calculated for rats receiving the 90% soluble concentrate formulation. This formulation is assigned to Toxicity Category I, corresponding to a high oral toxicity. Toxicity Category II has been assigned to the 24-31% soluble concentrate formulations.

No acute dermal toxicity data are available on either the 90% or 24-31% soluble concentrate formulations. Data on the technical material will be sufficient to satisfy the requirement for the 90% soluble concentrate formulations, placing this formulation in Toxicity Category II corresponding to a moderately acute dermal toxicity potential. Testing is needed for the 24-31% formulations.

No data on acute inhalation toxicity are available for the 90% soluble concentrate formulations. Testing on the technical grade material will fulfill this data requirement on the 90% soluble concentrate, placing these formulations in Toxicity Category II corresponding to moderate toxicity. A study using ChR-CD rats is available for the 24-31% soluble concentrate products. The LD_{50} value was determined to be 0.67 mg/liter, placing these formulations in Toxicity Category II.

No data on primary eye or primary dermal irritation are available on the soluble concentrate formulations. Testing is needed.

No data are available on the dermal sensitization of the soluble concentrate formulations. Requested testing on the technical material will fulfill this data requirement for the soluble concentrate formulations.

Topical Discussions

Acute Toxicity

Acute Oral Toxicity

Two studies were available to assess the 90% soluble concentrate formulations. An LD_{50} of 18 mg/kg was calculated for rats (sex unspecified) receiving this formulation (Margolin, 1977, 00007031). Toxic effects included clonic convulsions. In rhesus monkeys, 5 mg/kg of this formulation produced miosis in the one animal tested while 10 mg/kg and 20 mg/kg produced miosis, dyspnea, salivation, tremors, and fasciculations (Teeters, 1968, 00008506). All of the animals (4) died at 40 mg/kg. Atropine sulfate prevented mortality in animals administered 10 mg/kg of methomyl.

The oral LD_{50} value places the 90% soluble concentrate formulations into Category I, corresponding to a high acute oral toxicity potential. No additional testing is required.

Two studies were available to assess the oral toxicity 24-31% soluble concentrate formulations. The oral LD_{50} of Lannate (24% methomyl) in male rats was calculated to be 137.77 mg/kg with 95% confidence limits of 117.2-169.9 mg/kg (duPont, 1972, 00009233). Another study using 5 male rats per dose group (100 and 200 mg/kg) also indicated that the LD_{50} value would place the soluble concentrate formulation in Toxicity Category II (Barbo, 1972, 00007775).

Acute Dermal Toxicity

One study on a soluble concentrate formulation was reviewed and determined to be inadequate (Caddell and Majkut, 1967, 00008981). However, acute dermal toxicity data available on technical grade methomyl satisfies this data requirement for the 90% soluble concentrate.

Acute dermal testing is required on the 24-31% formulations.

Acute Inhalation Toxicity

Acute inhalation toxicity data available on technical grade methomyl satisfies this data requirement for the 90% soluble concentrate and places these formulations in Toxicity Category II.

A study using ChR-CD rats is available for the 24-31% soluble concentrate products (Brown, 1973, 00007774). The LC_{50} was determined to be 0.67 mg/liter and assigns these formulations to Toxicity Category II.

Primary Eye Irritation

No data were available to assess the primary eye irritation potential of methomyl soluble concentrate formulations. Testing is required.

Primary Dermal Irritation

One study on primary dermal irritation for soluble concentrate formulations was reviewed and determined to be inadequate. Testing is required for the 90% and 24-31% soluble concentrate products.

Dermal Sensitization

One study on dermal sensitization for soluble concentrate formulations was reviewed and determined to be inadequate. Requested testing on technical grade methomyl will fulfill this requirement for the soluble concentrate formulations. If testing on the technical is not provided, testing on these formulations will be required.

C. Granular Methomyl

Granular Methomyl Toxicology Profile

No data are available to assess the acute oral toxicity of methomyl granular formulations. Granular formulations containing 2.5% or less methomyl are not more toxic orally than methomyl dust formulations. Data on the dust formulations fill the requirement for the 2.5% or less granulars and assign these formulations to Toxicity Category III. Acute oral toxicity data are needed for granular formulations containing more than 2.5% methomyl.

An acute dermal toxicity study is available on a 1.25% methomyl granular formulation. the acute dermal LD_{50} value was greater than 2 g/kg in rabbits with abraded skin, placing granular formulations of 2.5% or less methomyl in Toxicity Category III. Testing on the technical material and granular formulations fulfill this requirement for granular formulations containing greater than 2.5% methomyl and assign these formulations to Toxicity Category III.

Two acute inhalation studies are available for granular formulations containing 2.5% or less methomyl. A study using a 1.25% granular formulation in rats resulted in a 4-hour LC_{50} value that was greater than 5.5 mg/liter, assigning these formulations to Toxicity Category III. In a second study, a 1-hour LC_{50} value was determined to be more than 200 mg/liter in rats, corresponding to Toxicity Category IV. Toxicity Category III is accepted for 2.5% or less granular formulations. Testing is required for granular formulations containing greater than 2.5% methomyl.

An adequate primary eye irritation study for a 1.25% granular formulation was conducted in rabbits. Based on the results of this study, granular formulations of 2.5% or less methomyl can be assigned to Toxicity Category II. testing is required for granular formulations containing greater than 2.5% methomyl.

A primary dermal irritation study for granular formulations is available. A 1.25% granular methomyl formulation was tested in rabbits. The results from this study satisfy the primary dermal irritation data requirement for granular formulations and assign these formulations to Toxicity Category IV.

No data were available to assess the dermal sensitization potential of granular formulations containing methomyl. Requested testing on the technical material will fulfill this data requirement on the soluble concentrate formulations.

Topical Discussions

Acute Toxicity

Acute Oral Toxicity

No data were available to assess the acute toxicity of methomyl granular formulations. Granular formulations of 2.5% or less methomyl are not more toxic orally than dust formulations. Therefore, the acute oral testing on dust formulations fills the requirement for 2.5% or less granular formulations and

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places these products in Toxicity Category III (Carroll, 1971, 00008963).

Testing is required on granular formulations containing more than 2.5% methomyl.

Acute Dermal Toxicity

An adequate acute dermal toxicity study was available on a 1.25% granular methomyl formulation. The acute dermal LD_{50} of Nu-Bait (1.25% methomyl) was greater than 2 g/kg in rabbits with abraded skin (Knapp and Doyle, 1979, 00009067). Edema and erythema were observed at the test site 24 hours after application in some animals. Based on these results, granular formulations of 2.5% or less methomyl can be assigned to Toxicity Category III.

Acute dermal toxicity data is not available on granular formulations of greater than 2.5% methomyl. Testing on the technical and granular formulations fulfill this requirement for the formulations containing greater than 2.5% methomyl and assign these formulations to Toxicity Category III.

Acute Inhalation Toxicity

An acute inhalation toxicity study is available for a 1.25% granular methomyl formulation (Fabian and Taylor, 1979, 00009065). The 4-hour LC_{50} value was greater than 5.5 mg/liter in rats, assigning the formulations of 2.5% or less methomyl to Toxicity Category III. Clinical signs included bloody nasal discharge, dyspnea, reduced locomotor activity, and clonic convulsions in 1 out of 10 animals.

In another study, a 1-hour LC_{50} value was determined to be more than 200 mg/liter in rats, which corresponds to Toxicity Category IV for this formulation (Margolin, 1977, 00007028).

These two inhalation studies are individually classified as supplementary. However, considering the studies together, Category III is accepted for 2.5% or less granular formulations of methomyl. Testing is required for granular formulations containing more than 2.5% methomyl.

Primary Eye Irritation

In an adequate primary eye irritation study, 0.1 g of a 1.25% methomyl formulation was tested in rabbits (Knapp and Doyle, 1979, 00009066). Mild corneal opacity and mild-to-moderate iritis were noted but both irritations cleared up by 72 hours after instillation. Conjunctival irritation was noted in all animals at 24 and 48 hours after instillation and cleared by 7 days. Based on these results, granular formulations containing 2.5% or less methomyl can be assigned to Toxicity Category II.

Testing is required for granular formulations containing greater than 2.5% methomyl.

Primary Dermal Irritation

In an adequate study, a granular formulation containing 1.25% methomyl was tested in rabbits (Knapp and Doyle, 1979, 00009068). At 24 hours, slight edema was observed at both abraded and intact test sites of all six animals tested, while slight erythema was noted at both abraded and intact test sites in 2 out of 6 animals. No skin irritation was observed at 72 hours.

The results from this study satisfy the primary dermal irritation data requirement for granular formulations and assign these formulations Toxicity Category IV, corresponding to low acute dermal irritation potential. Further testing is not needed.

Dermal Sensitization

No data were available to assess the dermal sensitization potential of granular formulations containing methomyl. Requested testing on technical grade methomyl will fulfill this requirement for granular formulations. If testing on the technical is not provided, testing on these formulations will be required.

D. Dust Formulations of Methomyl

Dust Formulations of Methomyl: Toxicology Profile

An acute oral toxicity study on methomyl dust formulations is available. The LD_{50} value for a 2% dust formulations was 4,061 mg/kg with a 95% confidence interval of 3,002-5,595 mg/kg in male rats. Based on these results, methomyl dust formulations can be assigned to Toxicity Category III.

No data are available on the acute dermal toxicity of methomyl dust formulations. Acute dermal toxicity of methomyl granular formulations satisifies this requiremeny for the dust formulations, assigning these formulations to Toxicity Category III.

No data are available to assess the acute inhalation toxicity or primary eye irritation of methomyl dust formulations. Testing is needed.

No data on the primary dermal irritation of methomyl dust formulations is available. Data available on other formulations fulfills this requirement for the dust formulations, assigning these formulations to Toxicity Category IV.

No data were available to assess the dermal sensitization potential of methomyl dust formulations. Requested testing on technical grade methomyl will fulfill this requirement for dust formulations.

Topical Discussions

Acute Toxicity

Acute Oral Toxicity

An acute oral toxicity study for dust formulations of methomyl is available (Carroll, 1971, 00008963). The acute oral LD_{50} value for a 2% dust was 4,061 mg/kg with a 95% confidence interval of 3,002-5,495 mg/kg in male rats. Signs of toxicity included tremors, fasciculations, salivation, and temporary weight loss.

Methomyl dust formulations can be assigned Toxicity Category III. Further testing is not needed.

Acute Dermal Toxicity

No data are available to assess the acute dermal toxicity of dust formulations containing methomyl. Acute dermal toxicity data submitted on granular methomyl formulations satisfies this data requirement for the dust formulations, assigning these formulations to Toxicity Category III. Further testing is not needed.

Acute Inhalation Toxicity

No data are available to assess the acute inhalation toxicity of dust formulations. Testing is required.

Primary Eye Irritation

No data are available to assess the primary eye irritation potential of dust formulations containing methomyl. Testing is required.

Primary Dermal Irritation

No data are available to assess the primary dermal irritation potential of dust formulations containing methomyl. Testing available on other formulations (Knapp and Doyle, 1977, 00009068) indicate that dust formulations can be assigned Toxicity Category IV. Further testing is not required.

Dermal Sensitization

No data were available to assess the dermal sensitization potential of dust formulations containing methomyl. Requested testing on technical grade methomyl will fulfill this requirement or dust formulations. If testing on the technical is not provided, testing on these formulations will be required.

Chapter VII

Residue Chemistry

Manufacturing-use Methomyl: Residue Chemistry Profile

Methomyl, S-methyl N-[(methylcarbamoyl)oxy]thioacetimidate, is a carbamate insecticide registered for use on a wide variety of agricultural crops.

In plants, methomyl is taken up by roots and translocated to the leaves. Methomyl applied to leaves is absorbed into the leaf tissue, but is not translocated to other portions of the plant.

Methomyl in plants is degraded to the volatile metabolites acetonitrile and CO_2. Neither the hydrolysis product of methomyl, S-methyl N-hydroxythioacetimidate, nor its glucoside conjugate have been identified as metabolites of methomyl in plants. In addition, the S-oxide and S,S-dioxides of methomyl have not been found in plant metabolism studies. Methomyl per se is the only residue of concern in plants.

The metabolism of methomyl in food-producing animals has not yet been defined.

Methomyl has been shown to be stable during long-term storage of fortified crop samples at near-freezing or subfreezing temperatures. Methomyl is not stable at elevated temperatures, and thus residue levels would be considerably reduced by high-temperature processing of commodities.

Methomyl and its hydrolysis product, S-methyl N-hydroxythioacetimidate, are determined together as the hydrolysis product by means of the gas-liquid chromatographic method of Pease and Kirkland. Recovery of methomyl from fortified crop samples is good for most raw agricultural commodities, and the sensitivity of the method is 0.02 to 0.05 ppm. The method is published in the Pesticide Analytical Manual, Volume II.

A large body of residue data exists that supports most uses of methomyl on agricultural crops. The residue data are mainly from foliar application of soluble concentrate formulations. Residues of methomyl decline rapidly, with an initial half-life of 1 to 2 days for the majority of crops. The rate of residue decline decreases with time.

2. Required Labeling

A prohibition against grazing or feeding cover crops in methomyl-treated orchards should replace the present restriction against grazing or feeding livestock on cover crops within 10 days of treatment. Other labeling need not be changed pending receipt and evaluation of new data required by this standard.

Topical Dicussions

Uptake, Distribution, and Metabolism in Plants

The absorption, distribution, and metabolic fate of methomyl in plants was investigated by Harvey and Reiser (1973, 05008206). ^{14}C-Methomyl applied to a single leaf of a tobacco plant could not be removed by washing the leaf with distilled water indicating that methomyl was taken up by leaf tissue. There was no evidence of migration of radioactivity from the treated leaf to other portions of the plant. In another test, extracts of methomyl-treated tobacco plants inhibited bovine red blood cell acetylcholinesterase. The degree of inhibition declined at a rate similar to the rate of decline of total radioactivity in treated leaves.

The metabolism of [1-^{14}C] methomyl was studied in corn and cabbage plants treated by foliar application of methomyl-containing solution, and in tobacco plants growing in a medium containing labeled methomyl (Harvey and Reiser 1973, 05008206). The studies were carried out in sealed chambers equipped with trapping trains for the collection of volatile compounds. Radioactive material in sodium hydroxide traps precipitable by $BaCl_2$ was assumed to be derived from $^{14}CO_2$. A volatile neutral compound present in cold traps was identified as [1-^{14}C] acetonitrile based on its partition properties in several organic solvent-water systems, and retention times identical to those of standard acetonitrile on 2 GLC columns. A small amount of ^{14}C-methomyl was recovered from the traps.

In extracts of the corn and cabbage plants, methomyl *per se* contributed less than 10% of the total radiolabeled material. The remaining radiolabeled material consisted of naturally occurring compounds such as lipids, glycolic acid, tartaric acid, sugars, and ninhydrin-positive compounds. These naturally occuring compounds were radiolabeled presumably from reincorporation of $^{14}CO_2$ (Harvey and Reiser 1973, 05008206).

A hydrolysis product of methomyl, S-methyl N-hydroxythioacetimidate, was not found in plant extracts. Treatment of the polar fraction of plant extracts with beta-glucosidase did not result in formation of the hydrolysis product, indicating that the product was not present in plants as a soluble glucoside conjugate. Also looked for, but not found in plant extracts were the S-oxide and S,S-dioxides of methomyl (Harvey and Reiser 1973, 05008206).

In cabbage and sweet corn treated with multiple applications of [1-^{14}C]methomyl under field conditions, the bulk of the radioactivity was in the outer leaves of cabbage and in corn fodder (plants minus ears). The distribution of radioactivity between methomyl *per se* and other compounds in extracts of field-grown cabbage leaves and corn fodder was similar to the distribution in cabbage and corn plants in the laboratory study (Harvey and Reiser 1973, 05008206).

It should be noted that the metabolism of methomyl in plants has thus far been studied with [1-^{14}C] methomyl, and thus the data reflect the disposition of the acetaldoxime moiety of the pesticide. The fate of the thiomethyl- and methyl carbamoyl groups were not discussed in the Harvey and Reiser study, but neither moiety would be expected to present a significant residue problem.

Stability of Residual Methomyl

There are some data to show that residual methomyl is stable during long-term storage at near-freezing or subfreezing temperatures. Methomyl on green beans was stable for 24 months at 0°-5°F (duPont 1974, GS0028-0018). Approximately 90% of methomyl added to mint hay was recoverable after 6 months at -10°C; (Wellman *et al*. 1972, 00007044). Methomyl added to tobacco was completely recovered after 83 days at -18°C (Leidy *et al*. 1977, 05008453) and nearly all of methomyl added to mint oil was recoverable after 5 months at 20°C.

Methomyl is not stable at high temperatures. Cooking of tomatoes, peas, or cabbage for 30 minutes in boiling water resulted in degradation of 70%, 92%, and 93%, respectively, of the residue initially on the samples (Holt 1971, 00007071). Processing of methomyl-fortified spinach under commercial conditions (252°F for 40 minutes) resulted in complete destruction of methomyl (Niven and Thornburg 1971, 00007948). Residues were not found in any fraction of heat-processed cottonseed that had been fortified with methomyl (duPont, 1971, GS-0028-0002).

The data on metabolism and degradation of methomyl in plants are considered adequate for purposes of this standard. The only terminal residue of concern is methomyl *per se*.

Metabolism in Food-Producing Animals

There are no data on the metabolism of methomyl in food-producing animals. This is a significant data gap in view of the number of major feed items with methomyl tolerances.

Analytical Methods

A gas-liquid chromatographic (GLC) method by which methomyl is determined as the hydrolysis product, S-methyl N-hydroxythioacetimidate, has frequently been used for residue analysis. Crop samples are blended with ethyl acetate and the homogenate clarified by centrifugation. Water is added to the extract, ethyl acetate evaporated from the mixture at room temperature, the watery residue acidified with sulfuric acid, and the suspension washed with hexane. The suspension is partitioned with chloroform and the chloroform extract carefully concentrated in a hood at room temperature. Sodium hydroxide is added to the concentrated solution and the mixture heated on a steambath. The basic solution is cooled, acidified with sulfuric acid, and extracted with ethyl acetate. The ethyl acetate extract is filtered through anhydrous sodium sulfate, the filtrate combined with a small amount of triethylamine, and the solution carefully concentrated at room temperature. The concentrated solution is analyzed on a column equipped with a sulfur microcoulometric detector. The amount of methomyl is determined from a standard curve. The claimed sensitivity of the method for most samples is 0.02 ppm. (Pease and Kirkland 19??, 00009009; also J. Agr. Food Chem. 16. 554 (1968)).

Pease subsequently modified the method, replacing the microcoulometric detector with a flame photometric detector equipped with a sulfur filter (Pease 1969, 00009074).

The hydrolysis product has been shown to survive the cleanup phase of the Pease and Kirkland method (approximately 50% recovery). [illegible] would therefore be determined as methomyl were it initially present on crop samples (duPont 1968, GS028-016). Various sulfur-containing compounds naturally present in some plants, cabbage for example, are also carried through the cleanup phase, but are adequately resolved from methomyl on GLC columns (Pease 1968, 00008837). The following sulfur-containing pesticides do not interfere with the determination of methomyl: 4-benzothienyl-N-methylcarbamate, captan, demeton, endosulfan, ferbam, malathion, maneb, methyl parathion, parathion, EPN, phorate, and aldicarb. Aldicarb survives the cleanup steps but is well separated from methomyl on the GLC column (Pease 1968, 00008837).

Recovery of methomyl from a variety of samples fortified with 0.02 to 2.0 ppm of the pesticide averaged 94% varying from 75% to 115% (Pease and Kirkland 19??, 00009009). Somewhat lower recoveries were reported in another study (Shell Development Co. 1975, 00007132). Recovery from 88 samples fortified with 0.07 to 10 ppm methomyl averaged 83%, with a standard deviation of approximately 12%.

The Pease and Kirkland method has been tried out successfully in an FDA laboratory (Eidelman, 1968, GS0028-0017). Recovery of methomyl from fortified samples averaged 70% for corn grain, 82% for cabbage, and 66% for milk. The Pease and Kirkland method is included in Volume II of the Pesticide Analytical Manual (PAM). Methomyl is apparently not determined by any of the multiresidue methods in Volume I of the PAM.

Residue Data Summary - Crops

The bulk of the residue data reflects use of soluble concentrate formulations. There are little data reflecting treatment with granular formulations; however, residues resulting from use of a granular formulation are not likely to exceed those resulting from use of a soluble concentrate at the same application rate and preharvest interval.

The residue data support most current uses of methomyl on raw agricultural commodities. Residues of methomyl decline rapidly, with an initial half-life of 1 to 2 days for most crops. The rate of residue decline decreases with time. Because of the rapid decline of methomyl residues, residue levels ordinarily reflect the last application.

There are insufficient data on residues in peppers, peaches, greenhouse-grown tomatoes, and sweet corn cannery waste. Data on residues in grapes grown east of the Rockies are needed. Additional data on residues in cabbage resulting from dust application are required.

For most crops, residues resulting from aerial application were similar to those from ground application; however, aerial use occasionally resulted in much higher residues on melons and peas, and additional data reflecting aerial application are needed for these crops. Data reflecting aerial application are also required for cauliflower, Brussels sprouts, and small grains if aerial use on these crops is to continue.

With the exception of peaches and of grapes grown east of the Rockies, there is an adequate geographic distribution of residue studies for all crops on which methomyl is registered for use.

There are no data on residues in orchard cover crops. The current 10-day pregrazing interval was based on a cattle feeding study which indicated that residues in meat and milk could not be detected (<0.02 ppm) at methomyl feeding levels of 20 ppm; and on residue data which demonstrated that residues in alfalfa would not exceed 10 ppm 7 days after application of 0.9 lb methomyl per acre. However, the cattle feeding study has been judged deficient in several respects (see Residues in Food-Producing Animals), and residues of methomyl on other forage crops are higher than those on alfalfa, indicating that alfalfa may not be a suitable model for orchard cover crops.

For processed commodities, there are sufficient data for apple pomace, mint oil, citrus byproducts, a fractionated oilseed crop (cottonseed), and raisins. Data on residues in tomato pomace are not being required because there is no concentration of residues in apple pomace which is similarly processed. Adequate data are not available on residues in sugar beet pulp.

Residue data for each of the crops for which methomyl is registered for use on are presented in Appendix A, Residue Data for Methomyl-Treated Crops, of this Standard.

Residues in Food-Producing Animals

Residues determined by the Pease and Kirkland method (methomyl and its oxime) were not detected (<0.02 ppm) in milk, lean muscle, subcutaneous fat, liver, and kidney of 2 cows maintained for 30 days on diets containing 2 and 20 ppm methomyl (duPont, 1967, 00008832).

The cow feeding study is inadequate for the following reasons: (1) the nature of the residue in cattle has not been defined, (2) an insufficient number of animals were studied, and (3) the feeding levels are not appropriate to tolerances in effect at this time. Current guidelines require that a minimum of 4 groups of 3 animals per group be administered 0, 1, 3, and 10x the maximum amount of pesticide active ingredient expected in the diet. Thus, because residues of 10 ppm may legally be present on several major items of cattle feed, some of which may comprise 80% of the diet, a cattle feeding study should include animals receiving 80 ppm methomyl.

Residues determined by the Pease and Kirkland method (methomyl and its oxime) were not detected (<0.02 ppm) in eggs, muscle, liver, fat, and skin of hens maintained for 4 weeks on diets containing up to 10 ppm methomyl (Sherman 1972, 00009365). The study is not adequate because the nature of the residue in poultry and eggs is not defined. The study would be considered adequate for purposes of this standard if metabolism data were to show that the residue of concern in poultry and eggs consists only of methomyl *per se* and its oxime.

Theoretical Maximum Residue Contribution

Tolerances for residues of methomyl have been established for a wide variety of food crops (40 CFR 180.253). Based on established tolerances, the theoretical maximum residue contribution (TMRC) of methomyl to the human diet is calculated to be 0.77 mg/day, assuming a 1.5 kg diet.

International Tolerances

Codex maximum residue limits (MRL's) have not yet been recommended for methomyl because a suitable Acceptable Daily Intake for methomyl has not been agreed upon by participating countries.

Methomyl tolerances have been established in some foreign countries that export food to the United States. The following table lists Canadian and Mexican tolerances for residues of methomyl on raw agricultural commodities, and, for comparison, the corresponding United States tolerances.

		TOLERANCES (ppm)	
Commodity	Canada	Mexico	United States
Alfalfa		10	10
Apples	0.5	1	1
Asparagus		2	2
Beans, dry		0.1	0.1(N)
Beans, forage		10	10
Beans, succulent		2	2
Broccoli		3	3
Cabbage	5		5
Celery	0.5	3	3
Citrus fruits	1	2	2
Corn, forage		10	10
Corn, fresh		0.1(N)	0.1(N)
Cottonseed		0.1(N)	0.1(N)
Grapes	4	5	5
Lettuce	2	5	5
Oranges		5	2 2
Peaches		5	5
Peanuts		0.1(N)	0.1(N)
Peas	—	5	5
Pecans		0.1	0.1
Peppers, chili		1	0.2(N)
Pineapple		0.2	
Sorghum, forage		1	1
Sorghum, grain		0.2(N)	0.2(N)
Soybeans		0.2(N)	0.2(N)
Soybeans, forage		10	10
Spinach		6	6
Squash		0.2(N)	0.2(N)
Tomatoes		1	0.2(N)
Wheat, hay, straw and forage		10	10
Wheat, grain		1	1

N = Negligible residue tolerance

Tolerances for residues of methomyl in or on oranges, chili peppers, and tomatoes are higher in Mexico than in the United States, and a tolerance for residues on pineapple has been established in Mexico but not in this country. Registration actions pending in the United States would result, if adopted, in tolerances of 0.2, 1.0, and 2.0 ppm in or on pineapple, tomatoes, and peppers, respectively, thereby accomodating the corresponding Mexican tolerances. A decision on whether to raise the 2 ppm United States tolerance on oranges to match the 5 ppm Mexican tolerance should be deferred until Mexico offers an opinion on Codex MRL's.

Canadian tolerances are either lower or equal to United States tolerances.

Group Tolerances

When the new crop grouping policy is published by the Agency, certain methomyl tolerances now in force may be altered to accomodate the crop grouping scheme. Some of the crop groups, members of which have methomyl tolerances, include: leafy vegetables, Brassica leafy vegetables, legume vegetables, fruiting vegetables, and small grains.

Hay Tolerances. To conform to current policy that separate tolerances be established for the forage and for the hay or straw of grains, graseese, and legumes, 40 CFR 180.253 should be amended as follows:

Delete tolerance(s) for:	Alfalfa	10 ppm
Add tolerance(s) for:	Alfalfa, fresh	10 ppm
	Alfalfa, hay	10 ppm
	Beans, hay	10 ppm
	Peavine, hay	10 ppm
	Soybeans, hay	10 ppm

Regulatory Incidents

There is no record of any enforcement action involving methomyl. There is no indication that methomyl residues are routinely monitored by FDA's surveillance programs.

Chapter VIII

ECOLOGICAL EFFECTS

Manufacturing-Use Methomyl

Ecological Effects Profile

Some information is available to characterize the toxicity of methomyl to various terrestrial and aquatic organisms.

One study was reviewed and considered adequate to characterize the dietary toxicity of methomyl to avian wildlife as slightly toxic. The 8-day dietary LC_{50} values were reported as 1100-1975 ppm for upland gamebirds and 2883 ppm for waterfowl. No acceptable study was available addressing the acute oral toxicity of technical methomyl to avian wildlife.

Two acute 96-hour LC_{50} fish (coldwater and warmwater) toxicity studies were sufficient to characterize methomyl as moderately toxic. The 96-hour LC_{50} values were reported as 1.05-1.88 ppm for a warmwater fish and 1.6 ppm for a coldwater fish.

One study was available to characterize the acute toxicity of technical methomyl to aquatic invertebrates as very highly toxic. The 48-hour LC_{50} value was reported as 31.7 ppb for Daphnia magna.

No data are available to assess the chronic toxicity of technical methomyl to non-target organisms.

One study was available concerning the phytotoxic effects of technical methomyl. In that study, a drench of 1.3 lb ai/plant was found to have no effect on Spanish cedar.

Data are available to assess the effects of methomyl on non-target soil and surface invertebrates. Methomyl has been shown to be highly toxic to ground beetles, parasitic wasps, predaceous mites, lacewings, stilt bugs, damsel bugs, and a predaceous coccinellid beetle. Data also show methomyl to be non-toxic to ground beetles when exposure was via poisoned cutworm larvae.

A field study showed methomyl to be moderately toxic to big-eyed bugs and various species of spiders.

Data are available on the effect of methomyl on beneficial insects. Methomyl has been shown to be highly toxic to honeybees exposed to direct treatment. However, data indicate that toxicity of methomyl to bees decreases rapidly with time.

Topical Discussions

Effects on Birds

Acute Toxicity

Acute oral LD_{50} data on either wild waterfowl or upland game birds are required. Information on the acute oral toxicity of methomyl to avian wildlife is not available. Data are needed.

Subacute Dietary Toxicity

Two acceptable dietary studies (Heath et al., 1972, 00010330; Hill et al., 1975, GS-0028-0020) were summary reports of the USDI Fish and Wildlife Service investigations into the effects of pesticides on avian wildlife. The studies reported 8-day dietary LC_{50} values of 1100 ppm for the bobwhite quail, 3124 ppm for the Japanese quail, 1975 ppm for the ring-necked pheasant, and 2883 ppm for the mallard duck. There is sufficient information to characterize the toxicity of technical methomyl to avian wildlife as slightly toxic.

Long-Term Testing

Chronic Toxicity

An avian reproduction study on one species of upland game bird (preferably the bobwhite quail) and one wild waterfowl (preferably the mallard duck) is required because the repeated application and use of methomyl on major crops can result in repeated exposure of methomyl to avian wildlife. No avian reproduction data are available. These data are needed.

Effects on Fish

Acute Toxicity

Coldwater Fish

A 96-hour toxicity study on one species of coldwater fish is required. An adequate 96-hour toxicity study on rainbow trout (Johnson and Finley, 1980, GS-0028-0026) is available. The 96-hour LC_{50} value was found to be 1.6 ppm. This information is sufficient to fulfill the data requirement and characterize the toxicity of technical methomyl to coldwater fish as moderately toxic.

Warmwater Fish

A 96-hour toxicity study on one species of warmwater fish is required. An acceptable 96-hour toxicity study on bluegill sunfish is available (USEPA, 1977, GS-0028-0028). The 96-hour LC_{50} value was found to be 1.88 ppm, characterizing the toxicity of technical methomyl to warmwater fish as moderately toxic.

Chronic Toxicity

There is insufficient information to characterize the chronic toxicity of methomyl to fish. A fish embryolarvae toxicity study is required since methomyl is intended for broad use, is persistent in water and the LC_{50} value is not much greater than 1 ppm. For further explanation of this requirement refer to Section 163.72-4(a) of the Proposed Guidelines.

Effects on Aquatic Invertebrates

Acute Toxicity

One 48-hour study is required to establish the acute toxicity of technical methomyl in aquatic invertebrates. An adequate study on Daphnia magna is available for technical methomyl (99% ai) (Goodman, GS-0028-0022). The 48-hour LC_{50} value was found to be 31.7 ppb. This information is sufficient to characterize the toxicity of methomyl to aquatic invertebrates as highly toxic.

Chronic Toxicity

There is insufficient information to characterize the chronic toxicity of methomyl to aquatic invertebrates. An aquatic invertebrate life-cycle toxicity test is required.

Effects on Estuarine Organisms

Acute Toxicity

No acute toxicity data on estuarine and marine organisms for technical methomyl are available. The requirement for this data is reserved pending the results of requested ecological effects and environmental fate data.

One study (Coppage, 1977, 05010817) investigated the anticholinesterase activity of several carbamate pesticides to estuarine/marine finfish. Technical methomyl was tested on pinfish, sheepshead minnow and sailfin molly. It was concluded that a 70% or greater brain acetylcholinesterase inhibition is causally related to poisoning and a high probability exists that some deaths have occured or will occur in fish populations so exposed to methomyl. Although the above study is scientifically sound, no existing requirement has been fulfilled by this study.

Effects on Non-target Soil and Surface Invertebrates

Acute Oral and Contact Toxicity

Predators and Parasites

The data available to assess the toxicity of methomyl to predator and parasite species are presented in Table 1 of this Chapter.

There is sufficient information to characterize methomyl as highly toxic to the following groups of insects: ground beetles, parasitic wasps, predaceous mites, lacewings, stilt bugs, and damsel bugs.

TABLE 1

Results of Toxicity Testing of Methomyl to Predator and Parasite Species

Species:	Test Substance:	Results:	Citation:
Ground beetles (*Stenolophus comma*, *Pterostichus melanarius*)	Technical	Highly toxic to adult S. comma at 0.01% (direct contact). Highly toxic to larval *P. melanarius* at 1.0 ppm dry weight in soil	Tomlin, 1975, 05009819
Green lacewing (*Chrysopa carnea*) Parasitic wasp (*Campoletis sonorensis*)	Technical	Highly toxic to both species	Plapp and Bull, 1978, 05004012
Carabid ground beetles	24% EC	At equivalent of 0.5 lb Al/acre in soil, highly toxic to 3 of 4 species. Not toxic when exposure was via poisoned cutworm larvae	Gholson et al., 1978, 05008149
Predaceous mite (*Metaseiulus occidentalis*)	24% EC	Highly toxic in lab and field tests.	Hoy et al., 1979, 05008360
Predaceous mite (*Typhlodromus pyri*)	1.8 EC	Highly toxic in lab test	Watve and Lienk, 1978, 05013359
Parasitic wasps	1.8 L	Highly toxic to all (5) test species at max. recommended rate for use on tomatoes	Waddill, 1978, 05009995

TABLE 1 (Cont.)

Species:	Test Substance:	Results:	Citation:
Predaceous beetles, hemipterans, Lacewings, etc.	Lannate L	Generally highly toxic to predaceous insects	Burkhardt et al., 1977, 00009042
Spined stiltbug (*Jalysus spinosus*)	90% SP	Highly toxic at 0.5 lb Al/acre	Elsey, 1973, 05003536
Big-eyed bugs (*Geocoris* spp.)	90% SP	No observable effects on nymphal maturation or fecundity at dosage allowing 50% survival	Walker et al., 1974, 05009371
Big-eyed bugs damsel bugs, spiders	90% SP	Moderately toxic to big-eyed bugs, spiders, highly toxic to damsel bugs	Turnipseed et al., 1975, 05010807
Predaceous beetle (*Stethorus punctum*)	25% WP	25% WP at 1 or 2 lb/100 gal. was highly toxic	Colburn, 1973, 00008898

One study (Colburn, 1973, 00008898) showed methomyl to be highly toxic to *Stethorus punctum* , a predaceous coccinellid beetle.

One study (Gholson *et al* ., 1978, 05008149) showed methomyl to be low in hazard to ground beetles, when exposure was via poisoned cutworm larvae.

Methomyl was found to be moderately toxic (Turnipseed *et al* ., 1975, 05010807) to big-eyed bugs and spiders under field conditions. Also, at a dosage allowing 50% survival, methomyl had no observable effects on nymphal maturation and fecundity in big-eyed bugs (Walker *et al*. ,1974, 05009371).

Honey bees

The data available on the acute oral and contact toxicity of methomyl to honey bees are presented on the next page.

There is sufficient information to characterize methomyl as highly toxic to bees exposed to direct treatment. Data indicate, however, that the toxicity of methomyl to bees decreases significantly within 2 hours following application.

Effects on Algae, Fungi, and Aquatic Macrophytes

Data were not available to assess the effects of methomyl on algae annd aquatic macrophytes. These data are required.

Effects on Terrestrial Macrophytes

A single study was evaluated concerning the phytotoxic effects of technical methomyl. In that study, a drench of 1.3 lb ai/plant was found to have no effect on Spanish cedar (Allan, 1973, 05008155).

Ecological Effects Profile

Formulated Methomyl Products

Two simulated field studies (Aftomis, 1973, 00010331; du Pont, 1972, 00009184) were considered adequate to assess the toxicity of liquid and granular methomyl to avian wildlife. The studies indicate that the 25% active ingredient liquid formulation (Lannate L^R) at 0.5 gallon/acre and the 5.25% active ingredient granular formulation (Lannate 5G^R) at 1 lb. a.i./acre pose little or no acute hazard to avian wildlife exposed under conditions similar to those in the tests.

A bluegill sunfish study (USDA, 1971, GS-0028-0014) and three acceptable rainbow trout studies (McCain, 1971, 00009226; USDA, 1971, GS-0028-0013; USDA, 1972, GS-0028-0012) were reviewed for a 90% active ingredient formulation of methomyl (Lannate^R). The 96-hour LC$_{50}$ values reported for Lannate^R were 2.15 ppm for the bluegill sunfish and 2.38-3.40 ppm for rainbow trout. Another bluegill sunfish study (USEPA, 1976, GS-0028-0011) was available for 24% active ingredient liquid formulation of methomyl (Lannate L). The 96-hour LC$_{50}$ value for Lannate L^R was 7.7 ppm. The acute toxicity of Lannate^R and Lannate L^R formulations can be considered moderately toxic to warmwater and coldwater fish.

TABLE 1

Species:	Test Substance:	Results:	Citation:
Honey bee (*Apis mellifera*)	Technical	Highly toxic at 100 ppm (direct contact)	Harris and Svec, 1969, 05011163
Honey bee Alkali bee (*Nomia melanderi*) Alfalfa leafcutter bee (*Megachile rotundata*)	90% WP	Moderately toxic to leafcutter and alkali bees, low in toxicity to honey bee (exposed to day-old residues of 1 lb/acre application.)	Johansen, 1972,
Honey bee alkali bee alfalfa leafcutter bee Bumble bee (*Bombus auricomus*)	90 SP	At 0.5 lb A/acre, killed 100% of honey bees exposed to direct application. Low in toxicity to honey bees exposed to 2 hr. old residues. Mod. tox to alkali bees and leafcutter bees, non-toxic to bumblebees, exposed to 2 hr. old residues	Sakamoto and Johansen, 1971, 00014715

Ecological Effects Hazard Assessment: Formulated Methomyl Products

Methomyl is registered for several outdoor uses, including major agricultural crops such as corn, soybeans, and cotton and non-agricultural uses such as forests. Many of the uses recommend or allow repeated applications. Exposure to non-target organisms can result from residues of direct applications, spray drift from treated areas and runoff from treated areas. Such exposures would be both acute and chronic. Environmental fate data on run-off and spray are not available to allow a hazard assessment to be made.

Additionally, the acute toxicity of methomyl to mammals at 17-24 mg/kg is considered to be high (See Toxicology, Chapter 6). The greatest risk to wild mammals, as can be determined from available information, is from exposure to the 1-2.5% bait formulations. These uses (except the 1% fly bait) should remain restricted until sufficient information is available to complete a hazard assessment, which would indicate appropriate classification.

Little information was available concerning the phytotoxic effects of methomyl to non-crop types of plants. Sufficient information exists to characterize the toxicity of methomyl to several crops. No information is available on the effects of methomyl on aquatic plants. The non-target plant assessment is limited to terrestrial plants.

Seventy to eighty percent of methomyl is used in soybeans, cotton, peanuts, and tobacco, with the remainder used on vegetables, fruits, and ornamentals. Rates are usually 1-2 applications of 0.2-.5 lb ai/acre, with a maximum of 2-3 applications at up to 0.9 lb. Most plants were uninjured at these treatment levels, although for many extensively tested species there were 1 or 2 tests in which the plant was more sensitive, and displayed phytotoxic symptoms when treated at normal rates. These variations are probably due to differences in variety, weather, or other growing conditions. Cotton was the only extensively tested plant which consistently displayed phytotoxic symptoms when treated at recommended rates.

Extrapolating from the plants tested to non-target terrestrial plants, it would appear that most plant species would be tolerant of methomyl even if exposed to full treatment at label rates. It is unlikely that large areas of non-target plants would be exposed to injurious concentrations of methomyl although some drift to adjacent strips of land would be expected from normal application patterns. If methomyl were appplied to natural vegetation or diverse ornamental plantings, phytotoxicity to some terrestrial plants would be expected due to the low tolerance that some plants exhibit.

Additional studies are required to assess the hazard of methomyl use to aquatic plants, or to assess the hazard to terrestrial plants in more detail.

Chapter IX

EFFICACY

Efficacy Profile

The review of methomyl data and the identification of data gaps are limited to efficacy data only as it relates to public health applications. In all other instances the Agency has provided for the waiver of efficacy data submission as a part of the registration process (44 FR 27932, May 11, 1979).

Efficacy data will be required for products intended for use either in premises or in the environment to control pests of public health significance such as houseflies.

There are two methomyl products (1% granular) which are registered for use as baits to attract and reduce housefly populations. Data for only one of these two products were considered since the other product is a multiple active ingredient formulation which contains muscalure fly attractant.

Factors Influencing Efficacy

Several factors may influence the efficacy of fly baits. Most important among these factors is that the bait must attract the flies and must be placed in areas where flies congregate. These two factors are important to ensure that a large portion of the fly population are exposed to the toxicant. Fly baits are formulated with an attractant such as sugar to attract flies to feed on the toxicant bait. The sex pheromone attractant, muscalure, is incorporated in some sugar-toxicant baits to enhance the attractiveness of the bait.

Use Sites

Animal Buildings and Outdoor Areas

The test data reviewed by the Agency demonstrate that methomyl granular fly bait containing 1% active ingredient reduces housefly populations at the following high population density use sites: pig parlors, poultry broiler houses, caged poultry houses, and buildings housing turkeys on wire (Berg, 1975, 00007012).

No data have been submitted for evaluating the effectiveness of methomyl 1% granular fly bait at dog kennels. Available data, however, will be considered adequate to demonstrate that methomyl 1% granular bait is effective in reducing housefly populations at this use site.

Non-Food Areas of Commercial Establishments

Data have not been submitted for evaluating the effectiveness of methomyl 1% granular fly bait when used in non-food sections of food, poultry and meat processing plants, and outside livestock holding pens or loading and unloading docks. Available data do show that the methomyl 1% granular fly bait effectively reduces housefly populations at high population density use sites such as pig parlors, poultry broiler houses, caged poultry houses, and buildings housing turkeys on wire. Since the efficacy of methomyl fly bait is not known to be site dependent, available data will be considered adequate to demonstrate that methomyl 1% granular fly bait is effective in reducing housefly populations when used in non-food sections of food, poultry and meat processing plants, and outside livestock pens or loading and unloading docks.

Target Pests

The common housefly (Musca domestica) is the only pest claimed on the registered label that falls within the Agency's area of public health concern. Laboratory studies, using houseflies from areas where phosphate resistance has been shown to exist, have demonstrated some cross-tolerance to methomyl (Gerolt, 1974, 05008150). Methomyl's toxicity to houseflies appears to be cumulative; a quantity of methomyl applied in small portions over a number of days was reported to be similar to that of the same amount applied in a single dose. Additionally, sublethal doses of methomyl were reported to enhance the efficacy of other chemicals which were subsequently applied (Gerolt, 1977, 05008151).

Appendix A
Residue Data for Methomyl-Treated Crops

Residue data are presented in this Appendix for each of the commodities as listed in 40 CFR 180.253. In some cases, data on related commodities listed separately in the CFR are grouped (e.g., data on lemons, oranges, grapefruit, and tangerines are under "citrus fruits"). Data under a commodity are subdivided by formulation type.

Residues on commodities were analyzed by the method of Pease and Kirkland (19??, 00009009) as modified by Pease (1969, 00009074). Unless otherwise noted, there is no restriction on the number of methomyl applications permitted, or on the interval between applications.

The bulk of the residue data reflects use of soluble concentrate formulations. There are little data reflecting treatment with granular formulations. However, residues resulting from use of a granular formulation are not likely to exceed those resulting from use of a soluble concentrate at the same application rate and preharvest interval.

Alfalfa. Ground and aerial application of soluble concentrates and granular baits to alfalfa may not exceed 0.9 active methomyl per acre per application. A minimum volume of 3 gal/acre is required for aerial application. For all products, there is a PHI of 7 days. A tolerance of 10 ppm has been established for residues of methomyl on alfalfa.

RESIDUE SUMMARY

SAMPLE	PHI (days)	RATE(S) (lb/acre)	RESIDUE DISTRIBUTION ppm <2	2-10	>10	REF.
SOLUBLE CONCENTRATE - SOLID						
Alfalfa/Ground application	0-4	0.25-1.0	0	9	6	a
Alfalfa/Ground application	1-4	0.9	4	8	6	b
Alfalfa/Ground application	5-8	0.9	18	6	0	b
Alfalfa/Ground application	5-14	0.25-2.0	13	7	0	a
Alfalfa/Aerial application	3-7	0.9	4	8	0	b
SOLUBLE CONCENTRATE - LIQUID						
Alfalfa/Ground application	0	0.45-0.9	0	0	2	c
Alfalfa/Ground application	7	0.45-0.9	4	2	0	c
Alfalfa/Ground application	7	0.45-0.9	0	4	0	d
Alfalfa/Aerial application	3-7	0.9	5	7	0	b
Alfalfa/Aerial application	7	1-2	12	4	0	c

Data were obtained in CA, CO, MI, NM, NV, NY, and PA.

a. duPont 1970, 00008984
b. duPont 1973, 00007159
c. Shell 1975, 00008039
d. Shell 1976, 00007133

Residues declined with a half-life of 1.5 to 3 days (calulated from data in reference a). Residues over tolerance were associated with a PHI of <4 days, and, to a lesser extent, with treatment level. The residue levels on green alfalfa (forage) were similar to those on dry alfalfa (hay).

At the maximum permitted application rate of 0.9 lb/acre PHI of 7 days, residue of methomyl on alfalfa forage and hay in excess of the 10 ppm tolerance are not expected.

Apples. Soluble concentrate, wettable powder, and granular bait formulations are registered for ground application to apples grown East of the Rockies. Trees may be sprayed with up to 0.45 lb active methomyl per 100 gal to a maximum of 400 gallons per acre per application. Baits may be applied up to 0.25 lb per acre per application. There is an 8-day PHI, and cover crops may not be fed or grazed within 10 days of the last application. A tolerance of 1 ppm has been established for residues of methomyl on apples.

RESIDUE SUMMARY

SAMPLE	PHI (days)	RATE(S) (lb/100_gal)	RESIDUE DISTRIBUTION ppm			REF.
			<0.2	.2-1.0	>1.0	
SOLUBLE CONCENTRATE - SOLID						
Apples	0-7	0.25-0.5	3	7	9	b
Apples	7-24	0.25-0.45	0	4	0	a
Apples	8-47	0.25-0.5	11	8	0	b
SOLUBLE CONCENTRATE - SOLID						
Apples	7-28	0.22-0.68	8	1	0	a
Apples	1-14	1.5-1.8†	1	5	0	a
WETTABLE POWDER						
Apples	1-7	0.25-0.5	1	2	5	a
Apples	8-21	0.25-0.5	4	5	0	a
Apples	0-21	1.7†	4	0	0	a

†Lbs per acre. Trees were treated with ≤ 35 gallons of diluted spray per acre. Some aerial applications are included in these studies.

The residue data were from 11 Eastern and Midwestern apple-producing states.

a. duPont 1976, GS0028-024
b. duPont 1971, 00007077

The data are sufficient to show that residues in or on apples will not ordinarily exceed the 1 ppm tolerance, 8 or more days after application of methomyl-containing soluble concentrates or wettable powders at rates up to 0.5 lb per 100 gallons per application.

Based on data from days 1 through 4, the half-life for residues of methomyl on apples is 1 to 2 days (reference b). After the first few days, the rate of residue decline is much slower.

Residues do not concentrate in any fraction of processed apples (duPont 1972, 00007070). Food additive tolerances are therefore not required for processed apples fractions.

There are no data on residues in cover crops growing in methomyl-treated apple orchards.

Asparagus. Soluble concentrate and granular bait formulations are registered for use on asparagus. Soluble concentrates are applied at a maximum rate of 0.9 lb active methomyl per acre per application, and granular formulations may be applied up to 0.25 lb per acre per application. There is a 1 day PHI. A tolerance of 2 ppm has been established for residues of methomyl on asparagus.

RESIDUE SUMMARY

SAMPLE	PHI (days)	RATE(S) (lb/acre)	RESIDUE DISTRIBUTION ppm			REF.
			<0.4	0.4-2	>2	
SOLUBLE CONCENTRATE - SOLID						
Asparagus/Ground application	1-5	0.5-10	30	0	0	a
Asparagus/Aerial application	1	1.0	4	0	0	a
SOLUBLE CONCENTRATE - LIQUID						
Asparagus/Ground application	0-5	0.45-1.0	20	14	0	a
Asparagus/Ground application	0	1.8	0	2	2	a
Asparagus/Ground application	1-3	1.8	5	3	0	a

Data were obtained in CA, MI, WA, and NJ.
a. dupont 1975, 00008938

Residues declined with a half-life of approximately 1 day (calculated from data in reference a). Residues over tolerance were seen only on the day of treatment at an application rate twice that of the registered maximum rate.

At the maximum permitted application rate of 0.9 lb/acre and PHI of 1 day, residue of methomyl on asparagus in excess of the 2 ppm tolerance are not expected.

Avocados. Application of soluble concentrates to avocado trees may not exceed 0.9 lbs active methomyl per acre per application. There is a 1-day PHI for avocados. A tolerance of 2 ppm has been established for residues of methomyl on avocados.

RESIDUE SUMMARY

SAMPLE	PHI (days)	RATE(S) (lb/acre)	RESIDUE DISTRIBUTION ppm			REF.
			<.4	.4-2	>2	
SOLUBLE CONCENTRATE - SOLID						
Avocados	1-21	0.9	17	1	0	a
SOLUBLE CONCENTRATE - LIQUID						
Avocados	0-14	0.45-0.9	6	0	0	a

Residue data were obtained in CA.
a. duPont 1978, GS00280005

The data indicate that residues in or on avocados will not exceed the 2 ppm tolerance 1 day after application of methomyl at rates up to 0.9 lb per acre per application.

There are no data on residues of methomyl in cover crops grown in avocado orchards.

Barley (See Grain crops).

Beans (including black-eyed peas, bush beans, cow peas, green beans, kidney beans, lima beans, navy beans, pinto beans, pole beans, snap beans, string beans, wax beans). Ground and aerial application of soluble concentrates and granular baits to beans may not exceed 0.9 lb active methomyl per acre per application. The minimum volume for aerial application is 2 gallons per acre. Succulent beans may not be harvested within 1 day of treatment at higher rates of 0.45 lb per acre or less, and within 3 days of treatment at higher rates. Dried beans may not be harvested within 25 days of treatment at all rates. There is a 3-day PHI for green vines (forage), and a 7-day PHI for vines cut for hay. Tolerances have been established for residues of methomyl in or on beans as follows: dried beans, 0.1 ppm (negligible residue); succulent beans, 2 ppm; and bean forage, 10 ppm.

RESIDUE SUMMARY

SAMPLE	PHI (days)	RATE(S) (lb/acre)	RESIDUE DISTRIBUTION ppm <0.02	.02-.1	>2	REF.
SOLUBLE CONCENTRATE - SOLID						
Dried beans/Ground applic.	0-25	0.25-1.0	23	2	0	a
Dried beans/Aerial applic.	0-25	0.25-1.0	16	0	0	a
SOLUBLE CONCENTRATE - LIQUID						
Dried beans/Ground applic.	1-7	0.45-0.9	2	0	0	a
Dried beans/Ground applic.	3	1.0-2.0	0	2	0	b
Dried beans/Aerial applic.	1-7	0.45-0.9	4	0	0	a

SAMPLE	PHI (days)	RATE(S) (lb/acre)	ppm <2	2-10	>10	REF.
SOLUBLE CONCENTRATE - SOLID						
Green vines/Ground application	1-2	0.2-0.5	2	2	0	c
Green vines/Ground application	3	0.45-0.9	2	0	0	a
Green vines/Ground application	3-7	0.2-1.0	13	5	0	c
Green vines/Aerial application	3-7	0.9	3	2	0	a
Green vines/Aerial application	3-7	0.9	4	1	0	d
SOLUBLE CONCENTRATE - LIQUID						
Green vines/Ground application	3	1.0	0	1	0	b
Green vines/Aerial application	3	0.45	2	0	0	b
Hay/Ground application	7	0.5-1.0	2	0	0	b
Hay Aerial application	7	0.45	2	0	0	b

			RESIDUE DISTRIBUTION			
			ppm			
SAMPLE	PHI (days)	RATE(S) (lb/acre)	<0.1	0.1-2	>2	REF.
SOLUBLE CONCENTRATE - SOLID						
Succulent beans/Ground appl.	1-7	0.2-0.5	18	3	0	c
Succulent beans/Ground appl.	1-7	0.45	4	0	0	e
Succulent beans/Aerial appl.	1-7	0.45	8	5	0	e
Succulent beans/Ground appl.	0-8	1.0	9	3	0	c
Succulent beans/Ground appl.	1-3	0.9	1	3	0	e
Succulent beans/Aerial appl.	1-7	0.9	7	0	0	d
Succulent beans/Aerial appl.	1-7	0.9	2	1	0	e
SOLUBLE CONCENTRATE - LIQUID						
Succulent beans/Ground appl.	1	0.22-0.45	4	0	0	f
Succulent beans/Ground appl.	1-3	0.5	2	0	0	b
Succulent beans/Aerial appl.	1	0.34-0.45	3	0	0	b
Succulent beans Aerial appl.	1-7	0.45	2	1	0	e
Succulent beans/Aerial appl.	3	0.45	1	0	0	f
Succulent beans/Ground appl.	1-6	1.0-2.0	7	0	0	b
Succulent beans/Aerial appl.	1	0.9	0	0	1	e
Succulent beans/Aerial appl.	3-7	0.9	1	1	0	e
Succulent beans/Aerial appl.	3	0.9	1	0	0	f

Data on dried beans were obtained in CA, CO, MI, OH, WI, and DE. Data on bean forage were obtained in FL, CA, MI, NC, MD, NJ, and MO. Data on succulent beans were obtained in FL, CA, OH, MI, CO, NJ, NC, MD, DE, MO, and IA.

a. duPont 1974, 00009154
b. Shell 1975, 00007134
c. duPont 1971, 00008264
d. duPont 1973, 00007168
e. duPont 1974, GS0028-021
f. Shell 1976, 00007135

Residues on beans and bean forage declined with a half-life of 1 to 2.5 days (calculated from data in reference c).

The data in the above table show that residues in succulent beans, dried beans, and bean forage are not likely to exceed established tolerances at the maximum application rates and PHI's now in effect.

There is a shortage of data on bean hay. If it is assumed that there is no loss of residues during the drying process, and that residues will concentrate up to fivefold during drying, then green vines may contain up to 2 ppm methomyl if residues in bean hay are not to exceed the 10 ppm tolerance. It can be seen from the data on bean forage that residues do not exceed 2 ppm, 5 or more days after application of ≤ 1 lb methomyl per acre. therefore at a maximum application rate of 0.9 lb per acre and a 7-day interval between application and the cutting of forage for hay, residues in bean hay are unlikely to exceed the tolerance.

Beets, tops (See Vegetables, Leafy - I.)

Blueberries. Soluble concentrates may be applied to blueberries at rates not exceeding 0.9 lb active methomyl per acre per application. Blueberries may not be treated within 3 days of harvest. A tolerance of 6 ppm has been established for residues of methomyl on blueberries.

RESIDUE SUMMARY

SAMPLE	PHI (days)	RATE(S) (lb/acre)	RESIDUE DISTRIBUTION ppm <1	1-6	>6	REF.
SOLUBLE CONCENTRATE - SOLID						
Blueberries	0-11	0.45	0	2	0	a
SOLUBLE CONCENTRATE - LIQUID						
Blueberries	0-11	0.45-0.56	9	10	0	a
Blueberries	0-1	0.9	1	1	2	a
Blueberries	3-8	0.9	2	6	0	a
WETTABLE POWDER						
Blueberries	0-11	0.13-0.5	10	0	0	a

All residue data were obtained in Michigan.
a. duPont 1976, 00008334

Apparent half-life for methomyl degradation on blueberries varied from 2 to 9 days (calculated from data in reference a).

The data indicate that residues of methomyl are unlikely to exceed the 6 ppm tolerance 3 days after application of methomyl at rates not exceeding 0.9 lb per acre per application.

Broccoli. Water-soluble concentrates and granular baits are registered for ground and aerial treatment of broccoli at rates up to 0.9 lb active methomyl per acre. Broccoli may not be harvested within 3 days of treatment. A tolerance of 3 ppm has been established for residues of methomyl on broccoli.

RESIDUE SUMMARY

SAMPLE	PHI (days)	RATE(S) (lb/acre)	RESIDUE DISTRIBUTION ppm <1	1-3	>3	REF.
SOLUBLE CONCENTRATE - SOLID						
Broccoli/Ground application	0-1	0.5-1.0	1	2	1	a
Broccoli/Ground application	0-1	0.5-1.2	2	0	4	b
Broccoli/Ground application	3-14	0.5-1.0	16	0	0	a
Broccoli/Ground application	3-14	0.5-2.0	16	1	0	b
Broccoli/Aerial application	1-7	0.45-0.9	14	2	0	b
SOLUBLE CONCENTRATE - LIQUID						
Broccoli/Ground application	1	0.9	0	0	1	b
Broccoli/Ground application	3-14	0.9	2	1	0	b
Broccoli/Aerial application	3	0.9	0	1	0	c

Data were obtained in CA, FL, NY, VA, and MI.
a. duPont 1968, 00008043
b. duPont 1974, GS0028-001
c. Shell 1976, 00007604

Methomyl on broccoli degraded rapidly, with a half-life of < 1 day from 0 to 3 days (based on data in references a and b above).

The data in the table are sufficient to show that residues in methomyl-treated broccoli are run likely to exceed the tolerance at a maximum application rate of 0.9 lb per acre and a 3-day PHI.

Brussels Sprouts. Soluble concentrates registered for use onn Brussels sprouts may be applied up to 0.9 lb active methomyl per acre per application. A granular bait formulation may be applied up to 0.25 lb per acre per treatment. There is a 3 day PHI for 90% solid concentrates, 24% (1.8 lb/gal) liquid concentrates, and the 1.25% bait formulation. For a 30% (2.4 lb/gal) liquid concentrate there is a 14 day PHI. A tolerance of 2 ppm has been established for residues of methomyl on Brussels sprouts.

RESIDUE SUMMARY

SAMPLE	PHI (days)	RATE(S) (lb/acre)	RESIDUE DISTRIBUTION ppm <1	1-2	>2	REF.
SOLUBLE CONCENTRATE - SOLID						
Brussels sprouts/Ground applic.	0-14	0.5-1.0	19	0	0	a
Brussels sprouts/Ground applic.	1-14	2.0	4	1	0	a
Brussels sprouts/Ground applic.	1-7	0.5-2.0	11	2	0	b
SOLUBLE CONCENTRATE - LIQUID						
Brussels sprouts/Ground applic.	1	0.9	1	0	0	b

Data were obtained in OR, NY, CA, IL, and FL.
a. duPont 1968, 00008043
b. duPont 1974, GS0028-001

The initial rate of degradation of methomyl on Brussels sprouts was rapid, within approximate half-life of 1 day between 1 and 3 days after treatment (calculated from data in reference a). Residues declined less rapidly after the third day.

The data in the table are sufficient to show that residues in or on Brussels sprouts treated with a solid water-soluble concentrate are unlikely to exceed the tolerance at a maximum application rate of 0.9 lb per acre and a 3-day PHI.

Data on residues resulting from application of liquid concentrates are inadequate, however, liquid and solid concentrates result in similar residue levels on other crops, and data in the above table show that residues do not exceed 1 ppm at a maximum rate of 0.9 lb per acre and a 3-day PHI. It is unlikely that residues from use of liquid concentrates would exceed the 2 ppm tolerance at the same maximum application rate and PHI.

There are not data reflecting aerial application.

Cabbage. Aerial or ground application of water-soluble concentrates and granular baits to cabbage may not exceed 0.9 lb active methomyl per acre. Dusts may be applied at rates up to 1.0 lb per acre. For aerial application of soluble concentrates, a minimum of 3 gallons per acre of diluted product is required. There is a 1-day PHI for all formulations used on cabbage. A tolerance of 5 ppm has been established for residues of methomyl on cabbage.

	RESIDUE SUMMARY		RESIDUE DISTRIBUTION ppm			
SAMPLE	PHI (days)	RATE(S) (lb/acre)	<1	1-5	>5	REF.
SOLUBLE CONCENTRATE - SOLID						
Cabbage/Ground application	0	0.5-1.0	0	1	1	a
Cabbage/Ground application	1-10	0.25-1.0	49	5	0	a
Cabbage/Ground application	1	0.9	2	1	0	b
Cabbage/Ground application	1-3	0.9-1.8	1	3	0	c
Cabbage/Ground application	1-5	1.0	3	0	0	d
Cabbage/Ground application	1	0.75	0	1	0	e
Cabbage/Aerial application	1	0.9	1	0	0	e
Cabbage/Aerial application	0-8	0.9	8	1	0	f
SOLUBLE CONCENTRATE - LIQUID						
Cabbage/Ground application	1	0.9	4	2	0	b
Cabbage/Ground application	1-3	0.9-1.8	2	2	0	c
Cabbage/Ground application	1	0.75	1	0	0	e
Cabbage/Aerial application	1	0.9	1	0	0	e

DUST						
Cabbage/Ground application	1-7	0.3-1.0	19	1	0	d

The bulk of the data was obtained in the following states: FL, TX, WI, AZ, SC, CA, OH, and NC.

a. duPont 1967, 00007928
b. duPont 1972, 00007039
c. WARF 1973, 00007715
d. duPont 1971, 00008964
e. duPont 1973, 00007168
f. duPont 1972, 00008679

Over 80% of the residue initially preeesent on cabbage was degraded by day 1, with a loss of 50% of the remaining residue by day 3. Residues declined less rapidly after the third day (calculated from data in reference a).

The data in the table are sufficient to show that residues in or on cabbage treated with liquid or solid water-soluble concentrates are unlikely to exceed the tolerance at a maximum application rat of 0.9 lb per acre and a 1-day PHI.

Data on residues resulting from application of dusts are inadequate. There are only 2 values reflecting maximum registered use, and values at lower treatment rates suggest that, on occasion, the tolerance may be exceeded.

Cauliflower. Aerial and ground application of soluble concentrates and granular baits to cauliflower may not exceed 0.9 lb active methomyl per acre. Preharvest intervals associated with use of methomyl on caulflower are inconsistent: for solid concentrates, some liquid concentrates, and some granular baits, there is a [illegible]-day PHI; while for other products there is a 7-day PHI for rates not exceeding 0.45 lb per acre, and a 14-day PHI for 0.45 to 0.9 lb per acre. A tolerance of 2 ppm has been established for residues of methomyl on cauliflower.

	RESIDUE SUMMARY		RESIDUE DISTRIBUTION			
			ppm			
SAMPLE	PHI (days)	RATE(S) (lb/acre)	0.5	0.5-2	>2	REF.
SOLUBLE CONCENTRATE - SOLID						
Cauliflower/Ground application	0-7	0.5	5	0	0	a
Cauliflower/Ground application	1-3	0.5-1.0	2	2	0	b
SOLUBLE CONCENTRATE - LIQUID						
Cauliflower/Ground application	1-7	0.45-0.9	15	1	0	b
Cauliflower/Aerial application	3	0.9	1	0	0	c

Data were obtained in CA, FL, and NY.

a. duPont 1968, 00008043
b. duPont 1974, CS0028-001
c. Shell 1976, 00007605

Although rather sparse, the data show that 3 or more days after ground application of a water-soluble concentrate at rates not exceeding 0.9 lb active methomyl per acre, residues inor on cauliflower are unlikely to exceed the tolerance.

Data on aerial application arer not adequate; however, data cnmany otehr crops indicates that ground and aerial application result in similar residue levels.

Celery (including anise). Aerial or ground appliatin of water-soluble concentrates and granular baits to celery may not exceed 0.9 lb active methomyl per acre. There is a 7-day PHI for use of methomyl-containing products on celery. A tolerance of 3 ppm has been establised for residues of methomyl on celery.

SAMPLE	RESIDUE SUMMARY PHI (days)	RATE(S) (lb/acre)	RESIDUE DISTRIBUTION ppm <1	1-3	>3	REF.
SOLUBLE CONCENTRATE - SOLID						
Celery/Ground application	1-5	0.5-1.0	7	5	2	a
Celery/Ground application	7-14	0.5-1.0	10	3	0	a
Celery/Ground application	7-14	1.5-2.0	3	0	2	a
Celery/Ground application	1	0.45-0.9	0	0	3	b
Celery/Ground application	7-14	0.45-0.9	9	0	0	b
Celery/Aerial application	1-5	0.45-0.9	0	1	6	b
Celery/Aerial application	7	0.45-0.9	0	2	0	b
Celery/Aerial application	1-5	0.9	2	1	2	c
Celery/Aerial application	7-13	0.9	1	1	0	c
SOLUBLE CONCENTRATE - LIQUID						
Celery/Ground application	1	0.45-0.9	0	0	3	b
Celery/Aerial application	1	0.45-0.9	0	0	3	b
Celery/Aerial application	5-7	0.9	6	0	0	d

Residue data were obtained in FL and CA.

a. duPont 1969, 00008803
b. duPont 1974, GS0028-001
c. duPont 1972, 00008679
d. Shell 1975, 00007136

Residues in or on celery decreased with an approximate half-life of 2 days (calculated from data in references a and c above).

The data are sufficient to demonstrate that 7 or more days after application of a water-soluble concentrate at a rate not exceeding 0.9 lb active mehtomyl per acre, residues in or on celery are unlikely to exceed the tolerance.

Chinese Cabbage (See Lettuce.)

Citrus (including grapefruit, lemons, oranges, tangerines, and tangelos). Ground or aerial applicaton of soluble concentrates and granular bait formulations may not exceed 0.9 lb per acre. Spray volumes for aerial application of soluble concentrrates andgranular bait formulations may not exceed 0.9 lb per acre. Spray volumes for aerial application of soluble concentrtes may not be less than 15 gallons per acre. There is a 1-day PHI for harvest of friuit, and an interval of 10 das to grazing or feeding cover crops to livestock. Use of methomyl on citrus is presently restricted to CA, FL, and AZ. A tolerance of 2 ppm has been established for residues of methomyl in or on grapefruit, lemons, oranges, and tangerines.

SAMPLE	RESIDUE SUMMARY PHI (days)	RESIDUE SUMMARY RATE(S) (lb/acre)	RESIDUE DISTRIBUTION ppm <0.5	RESIDUE DISTRIBUTION ppm 0.5-2	RESIDUE DISTRIBUTION ppm >2	REF.
SOLUBLE CONCENTRATE - SOLID						
Oranges/Ground application	1-8	0.75-1.0	16	2	0	a
Lemons/Ground application	1-8	1.0-2.0	9	1	0	a
Tangelos/Ground application	1-8	1.0	2	2	0	a
Grapefruit/Ground applic.	2-4	0.5-1.0	4	0	0	a
SOLUBLE CONCENTRATE - LIQUID						
Tangerines/Ground applic.	1	1.4-2.7	0	1	1	b
Grapefruit/Ground applic.	1	0.45-1.8	7	1	0	c
Lemons/Ground application	1	0.9-1.8	2	0	0	d
Oranges/Ground application	1	1.4-2.7	0	1	1	e
Grapefruit/Aerial applic.	1	0.9-1.8	4	0	0	c
Lemons/Aerial application	1	0.9-1.8	4	0	0	d
Oranges/Aerial application	1	0.9-1.8	4	0	0	e

Data were obtained in CA, FL, TX, and AZ.

a. duPont 1972, 00009070
b. Shell 1975, 00007140
c. Shell 1975, 00007137
d. Shell 1975, 00007138
e. Shell 1975, 00007139

The data are sufficient to demonstrate that 1 or more days after applicaton of a water-soluble concentrate at a rate not exceeding 0.9 lb active methomyl per acre, residues in or oncitrus fruits are unlikely to exceed the 2 ppm tolerance.

Residues do not concentrate in any fraction of processed citrus (duPont 1972, 00009070). Food additive tolerances aree therefore not required for processed citrus fractions.

There are no data on residues in cover crops growing in mehtomy-treated citrus orchards.

Collards (See Vegetables, Leafy - I.)

Corn (including field corn, sweet corn, and popcorn). Ground or aerial application of soluble concentrates and granular baits to corn may not exceed 0.45 lb active methomyl per acre. There is a 0-day PHI for corn ears, and a 3-day interval for feeding or grazing livestock on treated corn plants. A tolerance of 0.1 ppm has been established for residues of methomly on corn grain and fresh corn (kernels plus cob with husk removed); and a tolerance of 10 ppm for corn forage and fodder (including corn stover and cannery waste, i.e., cobs and husks).

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	RESIDUE SUMMARY		RESIDUE DISTRIBUTION			
SAMPLE	PHI (days)	RATE(S) (lb/acre)	ppm			
			<0.5	.05-.1	>.1	REF.
SOLUBLE CONCENTRATE - SOLID						
Kernels/Ground application	0-1	0.25-1.0	11	0	0	a
Kernels/Ground application	3-8	0.44-1.5	14	1	0	b
SOLUBLE CONCENTRATE - LIQUID						
Kernels/Ground application	0	0.23-0.45	2	0	0	c
Ears/Aerial application	0-1	0.6	4	0	0	d
			ppm			
SOLUBLE CONCENTRATE - SOLID			<2	2-10	>10	
Fodder/Ground application	3-7	0.44-0.75	7	0	0	b
Fodder/Ground application	3-7	1.0-1.5	4	2	2	b
Cannery waste/Ground appl.	3-8	0.5	4	1	0	b
Cannery waste/Ground appl.	3-8	1.0-1.5	2	3	4	b
SOLUBLE CONCENTRATE - LIQUID						
Cannery waste/Ground appl.	0	0.23-0.45	1	1	0	c
Forage/Ground application	3	0.23-0.45	1	1	0	c
Forage/Aerial application	3	0.6	2	0	0	d

Residue date were obtained primarily in 9 midwestern and southern states.

a. duPont 1967, 00007659
b. duPont 1968, 00008838
c. duPont 1972, 00007039
d. Shell 1976, 00007142

The data are sufficient to show that residues are unlikely to exceed the 0.1 ppm tolerance on fresh corn kernels and corn grain at a maximum application rate of 0.5 lb methomyl per acre. Similarly, residues are unlikely to exceed 10 ppm on corn kernels and corn grain at a maximum application rate of 0.5 lb methomly per acre. Similarly, residues are unlikely to exceed 10 ppm on corn forage or fodder 3 days after applicatrion of 0.5 lb per acre.

The data on cannery waste are inadequate. Only 2 samples of cannery waste were sampled on the day of treatment. Data on cannery waste from corn treated at 1.0 or 1.5 lb per acre (2x and 3x the maximum rate) and sampled 3 or more days after treatement suggest that residues on cannery waste from corn treated with 0.5 lb per acre will frequently exceed the tolerance on the day of treatment. Additional data on residues in cannery waste reflecting the registered use (0.5 per acre, 0-day PHI) are required. In the absence of additional data, a 3-day PHI for corn ears would be appropriate.

There are no data on residues in corn oil or other processed corn fractions.

Cottonseed. Ground or aerial treatment of soluble concentrates or granular bait formulations to cotton maynot exceed 0.68 lb active methomyl per acre per application. Minimum volume for aerial application is 3 gallons per acre. There is a 15-day PHI for all products used on cotton, and livestock may not be fed or grazed on treated plants. A tolerance of 0.1 ppm has been established for residues of methomyl on cottonseed.

RESIDUE SUMMARY

SAMPLE	PHI (days)	RATE(S) (lb/acre)	RESIDUE DISTRIBUTION ppm <.04	.04-.1	>.1	REF.
SOLUBLE CONCENTRATE - SOLID						
Cottonseed/Ground application	9-20	0.45-0.68	7	0	0	a
Cottonseed/Ground application	13-22	1.0-3.0	7	0	0	a
Cottonseed/Aerial application	7-21	0.45-1.35	13	3	0	a
Cottonseed/Aerial application	2-22	0.33-1.0	16	3	0	b
SOLUBLE CONCENTRATE - LIQUID						
Cottonseed/Ground application	13-20	0.5-3.0	10	0	0	a
Cottonseed/Aerial application	7-17	0.9-1.35	3	1	0	a
Cottonseed/Aerial application	15	0.68	0	2	0	c
Cottonseed/Aerial application	15	1.4	0	1	1	c
Cottonseed/Aerial application	15	0.9-1.8	4	0	0	d
DUST						
Cottonseed/Ground application	3-13	0.3-0.6	15	1	4	e
Cottonseed/Ground application	3-13	0.75-1.25	4	0	5	e
Cottonseed/Ground application	17,28	0.75-1.12	1	1	0	e

Residue data were obtained in: TX, AZ, NC, GA, CA, and SC.

a. duPont 1974, 00009135
b. duPont 1973, 00007690
c. Shell 1975, 00007989
d. Shell 1976, 00009075
e. duPont 1976, 00009378

The data demonstrate that residues in or on cottonseed are unlikely to exceed the 0.1 ppm tolerance 15 days after application of a soluble concentrate at a maximum rate of 0.68 lb methomyl per acre per application.

Residues from use of dust formulations are higher than those obtained with soluble concentrates. The data suggest that residues may frequently exceed the 0.1 ppm tolerance 15 days after application of dusts at rates up to 0.6 lb per acre. The data are insufficient to permit selection of an alternative PHI.

Residues were not transferred to either the meal or oil fractions oil heat-processed cottonseed that had been fortified with methomyl (duPont 1971, GS-0028-0002).

Cucurbits. (including cataloupes, casabas, crenshaws, cucumbers, honey balls, honeydew melons, melons, melon hybrids, muskmelons, Persian melons, pumpkins, summer squash, watermelons and their hybrids, and winter squash). Aerial or ground application of soluble concentrates and granular bait formulations to cucurbits may not exceed 0.9 lb methomyl per acre per application. There is a 2 gallon per acre minimum volume for aerial application of soluble concentrates. Cucurbits may not be harvested within 1 day of application of 0.45 lb or less per acre, and within 3 days of application of methomyl in excess of 0.45 lb per acre. A tolerance of 0.2 ppm (negligible residue) has been established for residues of methomyl in or on cucurbits.

RESIDUE SUMMARY

SAMPLE	PHI (days)	RATE(S) (lb/acre)	RESIDUE DISTRIBUTION ppm <0.05	.05-.2	>.2	REF.
SOLUBLE CONCENTRATE - SOLID						
Cucumbers	1	0.5	0	1	0	a
Cucumbers	2-5	0.5	2	2	0	b
Melons	0	0.5	1	0	0	a
Melons	0	0.5	0	1	0	b
Melons	1	0.45	0	1	0	a
Melons	2-7	0.5	10	3	0	b
Summer squash	1-7	0.5	3	2	0	b
Cucumbers	1	0.9-1.0	0	2	0	a
Cucumbers	1-5	0.75-1.0	4	1	0	b
Melons	0-1	0.9-1.0	1	2	0	a
Melons	0-2	1.0	1	2	0	b
Melons	3	0.9	1	0	0	a
Melons	3-7	1.0	6	7	0	b
Summer squash	1-7	1.0	1	2	0	b
SOLUBLE CONCENTRATE - LIQUID						
Melons	1	0.45	0	1	0	a
Cucumbers	1	0.9	0	2	0	a
Cucumbers	3	0.9-1.8	3	0	0	c
Cucumbers	3	1.0-2.0	3	3	0	d
Melons	1	0.9	1	2	1	a
Melons	3-4	0.9	1	2	0	a
Melons	4	0.9	0	0	2	e

The bulk of the residue data was obtained in CA, TX, FL, and AZ.

a. duPont 1976, 00009291
b. duPont 1972, 00007970
c. Shell 1976, 00009077
d. Shell 1975, 00009076
e. Shell 1975, 00007990

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Approximately 30% of the samples were treated by aerial application of soluble concentrates. In most cases there was no apparent difference in residue distribution between aerial and ground application, and data reflecting the 2 modes of application have been combined in the residue summary. However, in one Texas study (in reference e), residues from aerial application exceeded the 0.2 ppm tolerance in 11 of 12 samples of whole melons, peel, and pulp. Residues from 1.8 lb per acre treatment were approximately the same as those resulting from treatment at 0.9 lb per acre, and not proportionally higher. The residues may be due to post-harvest contamination, but we will require clarification on this point from the registrant. If post-harvest contamination can't be demonstrated, an increase in the tolerance of PHI will be necessary.

With the exception of the study discussed above, the data indicate that residues resulting from ground or aerial application of methomyl to cucurbits will not exceed the tolerance at the maximum application rates and PHI's now in effect.

Dandelions (see Vegetables, Leafy - I.)

Endive (escarole). (See Lettuce.)

Grain crops (includes small grains: Barley, Oats, Rye, and Wheat)
Ground or aerial application of soluble concentrates to small grains may not exceed 0.45 lb active methomyl per acre per application. Grain may not be harvested within 7 days of the last application, and livestock may not be fed or grazed on treated forage or straw within 10 days of the last application. Tolerances of 1 ppm have been established for residues of methomyl in or on the grain of barley, oats, rye, and wheat; and tolerances of 10 ppm have been established for residues of methomyl in or on the forage, hay, and straw of these grains.

RESIDUE SUMMARY

SAMPLE	PHI (days)	RATE(S) (lb/acre)	RESIDUE DISTRIBUTION ppm <.2	.2-1	>1	REF.
SOLUBLE CONCENTRATE - SOLID						
Wheat grain	1-12	0.45-1.0	13	2	0	a
Barley grain	5-12	0.45-0.9	4	0	0	a
Oat grain	12	0.45-0.9	2	0	0	a
SOLUBLE CONCENTRATE - LIQUID						
Wheat grain	1-8	0.45-1.0	16	2	0	a
Barley grain	5-12	0.45	1	3	0	a
Barley grain	5	0.9	0	0	1	a
Barley grain	12	0.9	1	0	0	a
Oat grain	12	0.45-0.9	2	0	0	a

SAMPLE	PHI (days)	RATE(S) (lb/acre)	RESIDUE DISTRIBUTION ppm <2	2-10	>10	REF.
SOLUBLE CONCENTRATE - SOLID						
Wheat forage	1-6	0.45	0	1	2	a
Wheat forage	7-14	0.45-1.0	8	0	0	a
Barley forage	3-6	0.45	0	0	2	a
Barley forage	14	0.45-0.9	2	0	0	a
Wheat straw	1-7	0.45-0.5	0	2	2	a
Wheat straw	8-12	0.45	1	1	0	a
Barley straw	5-12	0.45-0.9	2	2	0	a
Oat straw	5-12	0.45-0.9	2	2	0	a
Triticale straw	5-12	0.45-0.9	2	2	0	a
SOLUBLE CONCENTRATE - LIQUID						
Wheat forage	1-6	0.45	0	1	2	a
Wheat forage	7-14	0.45-1.0	11	0	0	a
Barley forage	3	0.45	0	0	1	a
Barley forage	14	0.45-0.9	2	0	0	a
Wheat straw	1-7	0.45-0.5	5	1	3	a
Wheat straw	8-14	0.45	1	2	0	a
Barley straw	5-12	0.45-0.9	4	2	0	a
Oat straw	5-12	0.45-0.9	3	1	0	a
Triticale straw	5-12	0.45-0.9	2	2	0	a

The residue data, all of which reflect ground application were obtained in MO, KS, MI, NB, OK, and Alberta, Canada.

a. duPont 1975, 00007612

The data indicate that residues resulting from ground application to wheat, barley, rye, and oats are unlikely to exceed tolerance levels at the maximum application rate and PHI's now in effect. Data supporting aerial application to small grains must be submitted for this use to continue.

During the milling process, residues are transferred primarily to the flour, with little residue being found in the bran (reference a). Residues in flour do not exceed those in grain, and food additive tolerances for flour are not needed.

Residues on wheat and barley forage decline with a half-life of 1.1 to 1.8 days (calculated from data in reference a).

Grapefruit (See Citrus.)

Grapes

Ground application of soluble soncentrates and granular baits may not exceed 0.9 lb per acre. Aerial application is not permitted. . There is a 1-day PHI for fresh grapes and raisins, and a 14-day PHI for wine grapes (based on flavor evaluation tests rather than on residues in wine grapes or wine). A tolerance of 5 ppm has been established for residues of methomyl in or on grapes.

RESIDUE SUMMARY

SAMPLE	PHI (days)	RATES(S) (lb/acre)	RESIDUE DISTRIBUTION ppm <1	1-5	>5	REF.
SOLUBLE CONCENTRATE - SOLID						
Grapes	1-3	0.5-1.0	29	9	0	a
Raisins	0-7	0.5-1.0	7	2	0	a
SOLUBLE CONCENTRATE - LIQUID						
Grapes	1	0.45-1.8	1	2	0	b

Residue data were obtained in CA and AZ
a. duPont 1973, 00007634
b. Shell 1975, 00007991

The data are sufficient to demonstrate that 1 or more days after application of a water-soluble concentrate (solid) at a rate not exceeding 0.9 lb active methomyl per acre, residues in or on grapes or raisins are unlikely to exceed the 5 ppm tolerance. Data obtained with liquid concentrates are sparse, however, studies on other crops demonstrate that residue distributions obtained with liquid and solid concentrates are very similar.

Data have been obtained only in CA and AZ. Additional residue data from states East of the Rockies are required, otherwise use of methomyl on grapes must be restricted to states West of the Rockies.

Residues do not concentrate in any fraction of processed grapes (duPont, 1972?, 00007657). Food additive tolerances are therefore not required for processed grape fractions.

Grass, Bermuda . Methomyl is registered under FIFRA Section 24(c) (special local needs) for use on Bermudagrass in AL, GA, FL, NC, and SC. Ground or aerial application of soluble concnetrates may not exceed 0.9 lb active methomyl per acre per application. For application there is a 2 gallon per acre minimum volume. There is a 7-day PHI for Bermudagrass forage, and a 3-day PHI for Bermudagrass hay. Tolerances have been established for residues of methomyl in or on Bermudagrass as follows: Bermudagrass forage, 10 ppm; Bermudagrass hay (dried and dehydrated), 40 ppm.

RESIDUE SUMMARY

SAMPLE	PHI (days)	RATES(S) (lb/acre)	RESIDUE DISTRIBUTION ppm <3	3-10	>10	REF.
Bermudagrass/Ground applic.	0-3	0.25-1.0	1	7	14	a
Bermudagrass/Ground applic.	7-14	0.25-1.0	18	2	0	a
Bermudagrass/Ground applic.	7-14	1.8-2.0	1	1	2	a
Bermudagrass/Aerial applic.	1-3	0.25-1.0	3	5	4	a
Bermudagrass/Aerial applic.	7	0.25-1.0	6	0	0	a
Bermudagrass+	1-15	0.33-0.45	10	0	0	b
Mixed grasses/Ground appl.	0-5	0.23-0.9	6	6	11	a
Mixed grasses/Ground appl.	7-14	0.23-0.9	15	5	2	a
Mixed grasses/Ground appl.	7-14	1.8	0	2	2	a
Mixed grasses+	0-6	0.25-1.0	1	2	18	b
Mixed grasses+	0-6	1.8-2.0	0	0	21	b
Mixed grasses+	7-16	0.25-1.0	23	10	3	b
Mixed grasses+	7-16	1.8-2.0	6	1	9	b

RESIDUE SUMMARY (HAY)

SAMPLE	PHI (days)	RATES(S) (lb/acre)	RESIDUE DISTRIBUTION ppm <10	10-40	>40	REF.
Bermudagrass hay/Ground appl.	1	0.25-1.0	1	4	1	a
Bermudagrass hay/Ground appl.	3-7	0.25-1.0	8	1	0	a
Bermudagrass hay/Ground appl.	3-7	2.0	0	1	1	a
Unprocessed, milled, and pelletized Bermudagrass hay (aerial application)	1	0.25-1.0	6	9	3	a
"	3-7	0.25-1.0	36	0	0	a

The bulk of the residue data was obtained in the following states: NC, FL, and MO.

a. IR-4 1977, GS0028-006

b. IR-4 1979, GS0028-003 (mode of application not reported)

+ application mode not reported

The data are sufficient to demonstrate that, with current pregrazing and preharvest intervals, residues in or on Bermudagrass forage and Bermudagrass hay are unlikely to exceed established toelrances after application of a water-soluble concentrate at a rate not exceeding 0.9 lb active methomyl per acre.

Residues on Bermudagrass declined with an initial half-life of 1 to 2 days. The rate of decline decreased with time (based on data in references a and b).

The data on mixed grasses indicate that data on Bermudagrass can not be used to support registration of methomyl-containing soluble concentrates on other grasses. Parameters such as maximum rate and pregrazing interval may have to be established for each grass on which methomyl is proposed for use.

Kale. (See Vegetables, Leafy - I.)

Lemons. (See Citrus.)

Lentils. Soluble concentrates maay be applied to lentils at rates not exceeding 0.9 lb active methomyl per acre per application. Lentils may not be harvested within 25 days of the last application, and forage and hay of lentils may not be fed to livestock. A tolerance of 0.1 ppm has been established for residues of methomyl in or on lentils.

There are no residue data reflecting application of methomyl to lentils. Use of methomyl on lentils is supported by the similar use of methomyl on dried beans and on soybeans.

Lettuce. (including endive, escarole, and Chinese cabbage). Aerial or ground application of water-soluble concentrates and granular baits to lettuce may not exceed 0.9 lb active methomyl per acre. Dusts are also registered for use on lettuce up to 0.9 lb methomyl per acre. For aerial application of soluble concentrates, a minimum of 3 gallons per acre of diluted product is required. There is a 7-day PHI for application rates not exceeding 0.45 lb per acre, and a 10-day PHI for rates between 0.45 and 0.9 lb per acre. A tolerance of 5 ppm has been established for residues of methomyl on lettuce.

RESIDUE SUMMARY

SAMPLE	PHI (days)	RATES(S) (lb/acre)	RESIDUE DISTRIBUTION ppm <1	1-5	>5	REF.
SOLUBLE CONCENTRATE - SOLID						
Lettuce/Ground application	0-6	0.25-0.5	20	10	16	a
Lettuce/Ground application	3-7	0.45	3	0	0	b
Lettuce/Ground application	7-14	0.25-0.5	49	6	0	a
Lettuce/Aerial application	1-12	0.45	29	3	0	c
Lettuce/Ground application	0-8	0.9-1.0	14	12	16	a
Lettuce/Ground application	3-7	0.9	3	0	0	b
Lettuce/Ground application	3-7	0.9	0	2	0	d
Lettuce/Ground application	4-14	1.0	3	3	0	e
Lettuce/Ground application	10-14	0.9-1.8	18	3	0	a
Lettuce/Aerial application	1-12	0.9	11	1	0	c
Lettuce/Aerial application	3-13	1.0	3	0	0	f
SOLUBLE CONCENTRATE - LIQUID						
Lettuce/Ground application	3-7	0.45	3	0	0	b
Lettuce/Aerial application	3	0.45	1	0	0	g
Lettuce/Aerial application	7-10	0.45	3	0	0	c
Lettuce/Ground application	3-7	0.9	3	0	0	b
Lettuce/Ground application	3-7	0.9	0	1	1	d
Lettuce/Aerial application	1-11	0.9	8	2	0	c
Lettuce/Aerial application	3	0.9	1	0	0	g

DUST						
Lettuce/Ground application	4-14	0.5	5	1	0	e
Lettuce/Ground application	4-14	1.0	3	4	0	e

The bulk of the residue data was obtained in CA, FL, and AZ.

a. duPont 1971, 00008264
b. duPont 1972, 00007039
c. duPont 1973, 00007168
d. WARF 1973, 00007715
e. duPont 1971, 00008964
f. duPont 1971, 00007175
g. Shell 1975, 00007992

The data are sufficient to demonstrate that with current PHI's and maximum application rates, residues in or onnlettuce are unlikely to exceed the tolerance of 5 ppm after application of a water-soluble concentrate or dust. Residue levels on leaf lettuce do not differ greatly from those on head lettuce.

Residues on lettuce declined with a half-life of 1 to 3 days (based on data in reference a).

Mint, hay. Aerial or ground application of water-soluble concentrates and granular baits to mint may not exceed 0.9 lb active methomyl per acre. Methomyl may not be applied to mint within 14 days of harvest. A tolerance of 2 ppm has been established for residues of methomyl on mint.

RESIDUE SUMMARY

SAMPLE	PHI (days)	RATE (S) (lb/acre)	RESIDUE DISTRIBUTION	ppm		REF.
			<.5	.5-2	>2	
SOLUBLE CONCENTRATE - SOLID						
Fresh mint hay	0-7	0.5-1.0	2	1	8	a
Fresh mint hay	0-7	0.5-1.0	2	2	4	b
Fresh mint hay	14	0.5-1.0	8	0	0	a
Fresh mint hay	14-19	0.5-1.0	8	0	0	b
Spent mint hay	14-16	0.5-1.0	3	0	0	a
Spent mint hay	18-19	0.5-1.0	6	0	0	b
Mint oil	16-17	0.5-1.0	8	0	0	a
Mint oil	18-19	0.5-1.0	8	0	0	b
SOLUBLE CONCENTRATE - LIQUID						
Fresh mint hay	0-8	0.5-1.0	3	3	5	a
Fresh mint hay	14-22	0.5-2.0	5	1	0	a
Fresh mint hay	20-25	1.0-2.0	4	0	0	c
Spent mint hay	9-23	0.5-1.0	7	0	0	a
Spent mint hay	20-25	1.0-2.0	2	0	0	c
Mint oil	9-20	0.5-2.0	17	0	0	a
Mint oil	20-25	1.0-2.0	2	0	0	c

All of the residue data were obtained in IN and OR.

a. Wellman et al. 1972, 00007044
b. Wellman et al. 1971, 00007043
c. Kiigemagi et al. 1976, 00007996

The data indicate that residues on fresh or spent mint hay are unlikely to exceed the 2 ppm tolerance 14 or more days after application of methomyl to growing mint at rates up to 0.9 lb per acre. Residues were not detected in any sample of mint oil, and therefore a food additive tolerance is not required for the oil.

The residue distribution resulting from aerial application did not differ from that resulting from ground application.

Mustard Greens. (see Vegetables, Leafy - I)

Nectarines and Peaches. Aerial or ground application of soluble concentrates to nectarines may not exceed 0.9 lb per acre per application, with a 10 gallon per acre minimum volume for aerial application. Use of methomyl on nectarines is restricted to CA and AZ. Ground application of soluble concentrates to peaches may not exceed 1.8 lb per acre per application. There is a 1-day PHI for nectarines, a 4-day PHI for peaches, and livestock may not be fed or grazed on treated cover crops within 10 days of treatment for both nectarines and peaches. A tolerance of 5 ppm has been established for residues of methomyl on nectarines and peaches.

RESIDUE SUMMARY

SAMPLE	PHI (days)	RATE(S) (lb/acre)	RESIDUE DISTRIBUTION ppm <1	1-5	>5	REF.
SOLUBLE CONCENTRATE - SOLID						
Nectarines/Ground applic.	0-1	0.9	2	0	0	a
Nectarines/Ground applic.	1-8	0.5-1.0	10	1	0	b
Nectarines/Ground applic.	1-8	2.0	4	2	1	b
Nectarines/Aerial applic.	1-3	0.75	2	0	0	a
Peaches/Ground application	1	1.5-2.0	0	0	2	b
Peaches/Ground application	4-8	1.5-2.0	1	3	0	b
SOLUBLE CONCENTRATE - LIQUID						
Nectarines/Ground applic.	0	0.9	2	0	0	a
Nectarines/Aerial applic.	1-3	0.75	2	0	0	a

Data were obtained in CA (nectarines) or DE (peaches).
a. duPont 1974, 00007832
b. duPont 1972, 00007672

The data indicate that residues on nectarines are unlikely to exceed the 5 ppm tolerance 1 day after application of a soluble concentrate at rates up to 0.9 lb per acre per application. The data on peaches are inadequate in terms of number of samples analyzed and geographical distribution to support the conclusion that residues will not exceed the tolerance 4 days after treatment with methomyl at rates up to 1.8 lb per acre. Further data on peaches are necessary.

There are no data on residues in cover crops growing in methomyl-treated peach or nectarine orchards.

Oats. (see Grain Crops).

Oranges. (see Citrus).

Parsley. (see Vegetables, Leafy - I).

Peaches. (see Nectarines).

Peanuts. (including Peanut Hulls). Ground or aerial application of soluble concentrates and granular baits may not exceed 0.9 lb active methomyl per acre per application. There is a 2 gallon per acre minimum volume for aerial application of soluble concentrates. Peanuts may not be harvested within 21 days of treatment. A tolerance of 0.1 ppm (negligible residue) has been established for residues of methomyl on peanuts and peanut hulls. A tolerance for residues of methomyl on peanut forage or hay has not been established, and therefore these commodities may not be fed to livestock.

RESIDUE SUMMARY

SAMPLE	PHI (days)	RATE(S) (lb/acre)	RESIDUE DISTRIBUTION ppm <.05	.05-.1	>.1	REF.
SOLUBLE CONCENTRATE - SOLID						
Nut meats/Ground application	7-40	0.45-0.9	7	0	0	a
Hulls/Ground application	7-40	0.45-0.9	6	1	0	a
SOLUBLE CONCENTRATE - LIQUID						
Whole peanuts/Aerial applic.	14	0.9	4	0	0	b
Nut meats/Mainly ground appl.	4-9	0.45-0.9	8	0	0	c
Nut meats/Aerial applic.	14	0.9	4	0	0	b
Nut meats/Aerial applic.	21	0.45-0.9	2	0	0	d
Hulls/Mainly ground appl.	4-9	0.45-0.9	6	2	0	c
Hulls/Aerial applic.	21	0.45-0.9	2	0	0	d
				ppm		
SOLUBLE CONCENTRATE - SOLID			<2	2-10	>10	
Foliage/Ground applic.	1-8	0.45-0.9	4	2	4	a
Hay/Mainly ground appl.	7	0.9	6	0	0	c
Forage/Mainly ground appl.	7-14	0.9	9	1	0	c
Foliage/Ground applic.	14-40	0.45-1.0	12	0	0	a
Foliage/Ground applic.	21-26	1.8-2.0	1	1	0	a
SOLUBLE CONCENTRATE - LIQUID						
Hay/Mainly ground appl.	1-8	0.45-0.9	3	3	7	c
Forage/Mainly ground appl.	2-14	0.45-0.9	4	1	0	c

The bulk of the residue data was obtained in NC and GA.

a. duPont 1971, 00007081
b. Shell 1976, 00009078
c. duPont 1979?, GS0028-004
d. Shell 1975, 00007997

The data indicate that residues on peanuts hulls are unlikely to exceed the 0.1 ppm tolerance 21 or more days after application of soluble concentrates to peanuts at rates up to 0.9 lb per acre.

If other requirements for obtaining a tolerance on peanut foliage were satisfied, the data above are sufficient to support a tolerance proposal. The data indicate that residues on peanut forage or hay are unlikely to exceed 10 ppm, 14 or more days after application of methomyl at rates up to 0.9 lb per acre.

There are no data on residues of methomyl in processed peanut fractions.

Peas. (including Pea Vines). Aerial or ground application of soluble concentrates and granular baits to peas may not exceed 0.9 lb active methomyl per acre per application. The minimum volume for aerial application of soluble concentrates is 3 gallons per acre. There is a 1-day PHI for harvest of peas, pea vines may not be grazed or fed within 5 days of application, and forage may not be cut for hay within 14 days of treatment. Tolerances have been established for residues of methomyl in or on peas as follows: peas, 5 ppm; and pea vines, 10 ppm.

RESIDUE SUMMARY

			RESIDUE DISTRIBUTION ppm			
SAMPLE	PHI (days)	RATE(S) (lb/acre)	<1	1-5	>5	REF.
SOLUBLE CONCENTRATE - SOLID						
Whole peas/Ground applic.	1-6	0.45-2.0	25	7	0	a
Whole peas/Ground applic.	1	0.9	3	0	0	b
Shelled peas/Ground applic.	1-5	0.45-2.0	8	1	0	a
SOLUBLE CONCENTRATE - LIQUID						
Whole peas/Ground applic.	1	0.9	3	0	0	b
Whole peas/Aerial applic.	1	0.9	2	0	0	c
Whole peas/Aerial applic.	3	0.9	1	0	0	b
Shelled peas/Ground applic.	0-3	0.45-1.8	8	0	0	c
Shelled peas/Ground applic.	3	0.45-0.9	2	0	0	d
Shelled peas/Aerial applic.	1-3	0.9	3	0	0	d
			<2	2-10	>10	REF.
SOLUBLE CONCENTRATE - SOLID						
Forage/Ground application	1-3	0.45-1.0	2	7	5	a
Forage/Ground application	5-7	0.45-1.0	8	4	0	a
Forage/Ground application	5-16	2.0	2	2	1	a
Hay/Ground application	14	0.9	0	3	0	b
SOLUBLE CONCENTRATE - LIQUID						
Forage/Ground application	1	0.9	0	0	1	c
Forage/Ground application	3	0.45-0.9	0	0	2	d
Forage/Aerial application	3	0.9	2	0	0	d
Forage/Aerial application	5	0.9	0	0	1	d
Hay/Ground application	14	0.9	0	3	0	b
Hay/Aerial application	11	0.9	0	1	0	b
Hay/Aerial application	13-14	0.9	2	1	0	d

The residue data were obtained in WA, MN, CA, WI, and IA.

a. duPont 1972, 00007683
b. duPont 1974, 00008154
c. Shell 1975, 00007999
d. Shell 1976, 00009079

The data indicate that residues resulting from ground application of methomyl to peas are unlikely to exceed tolerance levels at the maximum rate and PHI's now in effect.

Data reflecting aerial application to peas are inadequate. There are only 3 whole pea samples and 3 forage samples reflecting aerial application. One forage sample treated with 0.9 lb methomyl per acre contained 17 ppm residue 5 days after treatment (reference d). Additional data reflecting aerial application will be required to continue this use on peas.

Residues on pea forage decrease with an approximate half-life of 1 day (calculated from data in reference a).

Pecans. Soluble concentrates may be applied to pecan trees at rates not exceeding 0.9 lb per acre per application. There is a 30-day PHI for pecans following the last methomyl application. A tolerance of 0.1 ppm has been established for residues of methomyl on pecans.

RESIDUE SUMMARY

SAMPLE	PHI (days)	RATE(S) (lb/acre)	RESIDUE DISTRIBUTION ppm <.02	.02-.1	>.1	REF.
SOLUBLE CONCENTRATE - SOLID						
Shelled nuts	16-23	0.5-2.0	3	0	0	a
SOLUBLE CONCENTRATE - LIQUID						
Shelled nuts	16-21	0.45-0.9	9	0	0	a

Residue data were obtained in GA, FL, AL, and MS.
a. duPont 1976, 00008919

The data indicate that at a maximum application rate of 0.9 lb methomyl per acre, and a 30-day PHI, residues in or on pecans would not likely exceed the tolerance of 0.1 ppm.

There are no data on residues in cover crops growing in methomyl-treated pecan orchards.

Pomegranates. Soluble concentrates may be applied to pomegranates in California at rates up to 0.9 lb active methomyl per acre. Pomegranates may not be harvested within 14 days of treatment. A tolerance of 0.2 ppm (negligible residue) has been established for residues of methomyl on pomegranates.

RESIDUE SUMMARY

SAMPLE	PHI (days)	RATE(S) (lb/acre)	RESIDUE DISTRIBUTION ppm <.05	.05-.2	>.2	REF.
Pomegranates	1-6	0.67-0.9	0	2	5	a
Pomegranates	7-8	0.9	0	2	0	a
Pomegranates	1-7	0.45-0.9	0	1	3	b
Pomegranates	14	0.45-0.9	1	1	0	b

All of the residue data were obtained in CA.
a. duPont 1975, 00009003
b. LaRue and Dibble 1975, 00009002

The data suggest that the PHI should not be less than 14 days at a maximum rate of 0.9 lb per acre per application to insure that residues do not exceed the 0.2 ppm tolerance.

There are no data on residues in cover crops growing in methomyl-treated pomegranate orchards.

Rye. (See Grain Crops).

Sorghum. (including sorghum grain and sorghum forage). Aerial and ground application of soluble concentrates and granular bait formulations may not exceed 0.45 lb active methomyl per acre per application. A minimum of 2 gallons per acre is required for aerial application of soluble concentrates. There is a 14-day PHI, and livestock may not be grazed or fed treated sorghum within 14 days of the last application. In Arizona, granular formulations may be applied to immature sorghum at rates up to 1 lb active methomyl per acre, and immature sorghum so treated may not be fed, foraged, or ensiled. (The restriction is based on the composition of the formulation - see Confidential Appendix to the Product Chemistry Chapter). Tolerances have been established for residues of methomyl in or on sorghum as follows: forage, 1 ppm; and grain, 0.2 ppm (negligible residue).

RESIDUE SUMMARY

SAMPLE	PHI (days)	RATE(S) (lb/acre)	RESIDUE DISTRIBUTION ppm			REF.
			<.05	.05-.2	>.2	
SOLUBLE CONCENTRATE						
Grain/Ground application	7-8	0.45	0	2	2	a
Grain/Ground application	14	0.45-0.9	3	5	0	a
Grain/Ground application	14	1.0-2.0	1	1	0	b
Grain/Aerial application	3-13	0.33-0.67	2	2	1	b
Grain/Aerial application	15	0.33	0	2	0	b
GRANULAR FORMULATION						
Grain/Ground application	29-65	0.4-1.0	6	0	0	b
Grain/Aerial application	32-45	0.5-0.75	3	0	0	b
				ppm		
SOLUBLE CONCENTRATE			.2	.2-1	>1	
Foliage/Ground application	7-14	0.45	4	4	0	a
Foliage/Ground application	7-8	0.9	3	0	1	a
Foliage/Ground application	14	0.9	2	0	2	a
Foliage/Aerial application	3-13	0.33-0.67	1	2	2	b
Foliage/Aerial application	15	0.33	0	2	0	b
GRANULAR FORMULATION						
Foliage/Ground application	29-65	0.4-1.0	6	0	0	b
Foliage/Aerial application	32-45	0.5-0.75	3	0	0	b

The residue data were obtained from TX and AZ.

a. duPont 1974, 00008233

b. duPont 1971, 00009366

There was no difference between liquid and solid soluble concentrates in the distribution of residues on sorghum grain and foliage. The data for the two formulation types have been combined in the table.

The data indicate that residues on sorghum grain and forage are unlikely to exceed tolerance levels 14 days after application of methomyl-containing soluble concentrates at rates up to 0.45 lb active methomyl per acre per application.

There are no data for granular formulations reflecting PHI's less than 29 days. Thus a PHI of less than 29 days would not be acceptable even if the composition of the granular formulations were changed.

Soybeans. (including soybean forage). Aerial and ground application of soluble concentrates and granular bait formulations maynot exceed 0.9 lb active methomyl per acre per application. A minimum of 2 gallons per acre is required for aerial application of soluble concentrates. There are PHI's of 3 days for green forage and 7 days for forage cut for hay at application rates up to 0.45 lb per acre; and intervals of 10 days for forage and 12 days for forage cut for hay at rates from 0.45 to 0.9 lb per acre. There is a 14-day PHI for beans at all application rates. Tolerance have been established for residues of methomyl in or on soybeans as follows: forage, 10 ppm; and beans, 0.2 ppm (negligible residue).

RESIDUE SUMMARY

SAMPLE	PHI (days)	RATE(S) (lb/acre)	RESIDUE DISTRIBUTION ppm <.05	.05-.2	>.2	REF.
SOLUBLE CONCENTRATE - SOLID						
Beans/Ground application	7-14	0.9-1.8	6	2	0	a
Beans/Ground application	12	0.5-1.0	2	0	0	b
Beans/Aerial application	3	0.45	1	0	0	c
Beans/Aerial application	3-21	1.0	1	3	0	d
SOLUBLE CONCENTRATE - LIQUID						
Beans/Ground application	14	0.45-1.8	3	0	0	e
Beans/Ground application	14	0.5-1.8	6	0	0	a
Beans/Ground application	14	0.5-1.0	4	0	0	f
Beans/Aerial application	6	0.23-0.45	2	0	0	c
			<2	2-10	>10	
SOLUBLE CONCENTRATE - SOLID						
Forage/Ground application	1-14	0.5	10	0	0	b
Forage/Ground application	2	0.45	0	0	1	d
Forage/Ground application	7-21	0.45	2	1	0	d
Forage/Aerial application	3-7	0.45	2	0	0	c
Forage/Ground application	0-7	0.9	2	0	2	d
Forage/Ground application	3-14	1.0	6	2	0	b
Forage/Ground application	14-21	0.9	2	0	0	d
Forage/Aerial application	3-21	0.9-1.0	7	0	0	d
Hay/Ground application	7-14	0.9-1.8	4	0	0	a

SOLUBLE CONCENTRATE - LIQUID						
Forage/Aerial application	3-7	0.45	2	2	0	g
Forage/Aerial application	6	0.23-0.45	2	0	0	c
Forage/Ground application	7	0.45	1	0	0	e
Forage/Ground application	7	0.9-1.8	2	0	0	e
Hay/Ground application	14	1.0-2.0	4	0	0	a

Residue data were obtained primarily in 7 Midwestern and Southern states.

a. duPont 1979, 00003998
b. duPont 1971, 00008264
c. duPont 1974, 00003411
d. duPont 1976, 00008602
e. Shell 1975, 00007008
f. Shell 1975, 00009083
g. Shell 1975, 00009084

The data demonstrate that residues in or on soybeans and soybean forage are not likely to exceed established tolerances if the maximum application rates and PHI's now in effect are observed.

Data on dry forage (hay) are sparse, however calculated values (reference b) based on residues in succulent forage and on sample dry weights indicate that residues in dry forage are unlikely to exceed 10 ppm 7 days after application of 0.45 lb methomyl per acre, or 10 days after application of 0.9 lb methomyl per acres.

There are no valid data on residues of methomyl in processed soybean fractions.

Spinach. Aerial and ground application of soluble concentrates and granular bait formulations may not exceed 0.9 lb active methomyl per acre per application. A minimum of 3 gallons per acre is required for aerial application of soluble concentrates. Spinach may not be harvested within 7 days of the last application. A tolerance of 6 ppm has been established for residues of methomyl in or on spinach.

RESIDUE SUMMARY

SAMPLE	PHI (days)	RATE(S) (lb/acre)	RESIDUE DISTRIBUTION ppm <1	1-6	>6	REF.
SOLUBLE CONCENTRATE - SOLID						
Spinach/Ground application	0-5	0.5-1.11	1	10	9	a
Spinach/Ground application	1-5	0.5-1.0	4	5	7	b
Spinach/Ground application	7-14	0.5-2.0	19	3	0	a
Spinach/Ground application	7-15	0.5-1.0	8	6	0	b
Spinach/Aerial application	4-7	0.3-1.2	4	1	0	b
SOLUBLE CONCENTRATE - LIQUID						
Spinach/Ground application	3	0.5-1.0	0	1	2	b
Spinach/Ground application	7	0.5-1.0	0	4	0	b
Spinach/Ground application	0-14	0.45-0.9	6	6	0	c
Spinach/Ground application	7	0.9-1.8	2	2	0	d
Spinach/Ground application	7	0.9	1	1	0	e
Spinach/Aerial application	7	0.9	0	2	0	d

Residue data were obtained in: CA, TX, WA, FL, AR, TN, and NY.
a. duPont 1971, 00007185
b. duPont 1974, GS0028-001
c. Shell 1975, 00007002
d. Shell 1976, 00007001
e. Shell 1976, 00007003

The data demonstrate that residues in or on spinach are unlikely to exceed the tolerance of 6 ppm, 7 or more days after application of methomyl at rates not in excess of 0.9 lb per acre per application.

Based on seven sets of spinach serially sampled after methomyl treatmtne, the half-life of residues on spinach is 1.7 days (standard deviation = 0.4 days). (based on data in reference a).

Strawberries. Application of solule concentrates to strawberries may not exceed 0.9 lb active methomyl per acre per application. There is a 3-day PHI for fresh strawberries and a 10-day PHI for strawberries to be processed. The latter restriction is based on flavor evaluation tests rather than residue levels. A tolerance of 2 ppm has been established for residues of methomyl on strawberries.

RESIDUE SUMMARY

SAMPLE	PHI (days)	RATE(S) (lb/acre)	RESIDUE DISTRIBUTION ppm <.5	.5-2	>2	REF.
SOLUBLE CONCENTRATE - SOLID						
Strawberries	0-2	0.45-0.9	26	10	0	a
Strawberries	0-2	1.8	3	2	2	a
Strawberries	3-8	0.45-1.8	16	4	0	a
SOLUBLE CONCENTRATE - LIQUID						
Strawberries	0-2	0.45-0.9	11	5	0	a
Strawberries	0-2	1.8	3	3	1	a
Strawberries	3-8	0.45-1.8	7	2	0	a
Strawberries	3-10	0.5-2.0	13	0	0	b

The residue data were obtained in CA, NY, and WA.
a. duPont 1974, 00008847
b. duPont 1979, 00009004

The data indicate that residues in or on strawberries are unlikely to exceed the 2 ppm tolerance 3 or more days after application of soluble concentrates at rates not exceeding 0.9 lb active methomyl per acre.

Swiss chard. (see Vegetables, Leafy - I)

Tangerines. (see Citrus).

Tobacco. Application of soluble concentrates and dusts to tobacco may not exceed 0.45 lb active methomyl per acre per application. Granular formulations may be applied at rates up to 0.9 lb per acre per application. There is a 5-day PHI for flue-cured tobacco and a 14-day PHI for air- or fire-cured tobacco. Although tolerances are not established on tobacco in the U.S., residue data are required (Proposed Guidelines, Section 163.64-1) to assess the exposure to man resulting from consumption of pesticide-treated tobacco products.

RESIDUE SUMMARY

SAMPLE	PHI (days)	RATE(S) (lb/acre)	RESIDUES (ppm)	REF.
SOLUBLE CONCENTRATE				
Green leaves	0-3	0.5	88,44,18,19,7,6	a
Green leaves	5-9	0.5	1.4,0.7,0.2,0.06	a
Green leaves	7	0.45	0.10	b
Green leaves	16	0.45	<0.05 (2 values)	b
Green leaves	0-3	1.0	113,105,55,48,15,14	a
Green leaves	5-9	1.0	2.8,4.1,1.7,0.22	a
Flue-cured	1-3	0.5	2.1,1.8,0.5,0.5	a
Flue-cured	5	0.4	0.03,0.08,0.25	c
Flue-cured	5	0.5	0.12,0.16	a
Flue-cured	12-19	0.4	0.03,0.03,<0.05	c
Flue-cured	1-3	1.0	7.8,7.9,1.2,1.3	a
Flue-cured	5	1.0	0.43, 0.45	a
DUST				
Green leaves	6-14	0.5	<0.02 (5 values),0.7	d
Cigar wrapper (cured)	0-1	1.07-1.23	22, 30, 32, 103	c
Cigar wrapper (cured)	7	1.07-1.23	8.4	c
Cigar wrapper (cured)	14	1.07-1.23	3.9	c

Residue data were from NC, FL, and GA

a. Leidy et al. 1077, 05008453
b. Shell 1975, 00007005
c. Tappan et al. 1973, 05013872
d. duPont 1971, 00008964

The data indicate that residues on green tobacco, on flue-cured tobacco at 5 days, and on cigar-wrapper tobacco at 14 days, exceed 0.1 ppm. Accordingly, data on residues in smoke are required by the Proposed Guidelines [Section 163.64-1(c)]. Such data have not yet been submitted.

The half-life for residues on methomyl-treated tobacco is approximately 1 day (based on data in reference a).

Turnip greens, tops. (See Vegetables, Leafy - I).

Vegetables, fruiting (including eggplants, peppers, pimentos and tomatoes). Aerial or ground application of soluble concentrates and granular bait formulations to field-grown tomatoes may not exceed 0.9 lb active methomyl per acre per application. There is a 1-day PHI for application rates not exceeding 0.45 lb per acre, and a 2-day PHI for rates over 0.45 lb per acre. For treatment of greenhouse-grown tomatoes in NC and OH,, a maximum of 0.9 lb methomyl/200 gallons spray may be applied. For this greenhouse use there is a PHI of 7 days for rates not exceeding 0.45 lb/200 gallons, and a 14-day PHI for rates over 0.45 lb/200 gallons. Aerial or ground application of soluble concentrates and granular bait formulations to peppers may not exceed 0.45 lb active methomyl per acre per application, and peppers may not be harvested within 10 days of treatment. Application of soluble concentrates to eggplants may not be harvested within 5 days of treatment. A tolerance of 0.2 ppm (negligible residue) has been established for residues of methomyl on fruiting vegetables.

RESIDUE SUMMARY

SAMPLE	PHI (days)	RATE(S) (lb/acre)	RESIDUE DISTRIBUTION ppm			REF.
			<.05	.05-.02	>02	
SOLUBLE CONCENTRATE - SOLID						
Tomatoes/Ground application	0-5	0.25-0.5	17	4	0	a
Tomatoes/Ground application	1	0.5	1	0	0	b
Tomatoes/Aerial application	0-2	0.45-0.5	4	0	0	b
Greenhouse tomatoes	0-3	0.5*	0	1	3	c
Greenhouse tomatoes	6-7	0.5*	0	2	1	c
Tomatoes/Ground application	0-1	1.0	0	7	4	d
Tomatoes/Ground application	0-3	0.9	0	5	0	e
Tomatoes/Ground application	0-5	1.0	6	1	0	a
Tomatoes/Ground application	1-2	0.9-2.0	2	1	0	b
Tomatoes/Ground application	2-5	1.0	4	4	0	d
Tomatoes/Aerial application	1	0.6	0	0	1	e
Tomatoes/Aerial application	0-2	0.9-1.0	3	1	0	b
Greenhouse tomatoes	0-3	1.0*	0	0	4	c
Greenhouse tomatoes	6-7	1.0*	0	0	3	c
Peppers/Ground application	1-3	0.45-0.5	0	1	3	e
Peppers/Ground application	2-7	0.5	2	5	4	a
Peppers/Ground application	10	0.5-2.0	1	2	0	a
Peppers/Ground application	14	0.9	0	1	1	e
Eggplants/Ground application	1-3	0.45-0.9	0	2	2	f
Eggplants/Ground application	2-4	0.5-1.0	1	4	1	a
Eggplants/Ground application	5-8	0.5-1.0	4	2	0	a
Eggplants/Ground application	7	0.45-0.9	0	2	0	f
SOLUBLE CONCENTRATE - LIQUID						
Tomatoes/Ground application	0-4	0.45	2	2	0	e
Tomatoes/Ground application	1	0.5	1	0	0	b
Tomatoes/Aerial application	0-2	0.5	1	2	0	b
Tomatoes/Aerial application	1	0.45	2	0	0	g
Tomatoes/Ground application	1	0.9	1	1	0	e
Tomatoes/Ground application	1	1.8	0	0	1	e
Tomatoes/Ground application	1-2	0.9-2.0	1	2	0	b
Tomatoes/Aerial application	0-2	0.9-1.0	1	3	0	b
Tomatoes/Aerial application	2	0.9	2	0	0	g
Peppers/Ground application	1-3	0.5	0	1	1	e
Peppers/Aerial application	10	0.45	1	0	0	h
Peppers/Aerial application	10	0.45	2	0	0	i

* lb per 200 gallons
Residue data were obtained primarily in FL, CA, TX, and OH.
a. duPont 1969, 00007094

b. duPont 1972, 00007039
c. Krueger et al. 1973, 05009890
d. duPont 1971, 00008742
e. duPont 1974, 00007626
f. duPont 1969 00009000
g. Shell 1975, 00007007
h. Shell 1976, 00006996
i. Shell 1976, 00006995

The data demonstrate that, with the maximum application rates and PHI's now in effect, residues in or on field-grown tomatoes are unlikely to exceed the tolerance.

The data indicate that residues on greenhouse-grown tomatoes will frequently exceed the tolerance at the application rates and PHI's now registered. The data at hand do not permit selection of alternative PHI's, therefore additional data on greenhouse-grown tomatoes are needed.

Data on eggplants are sufficient to conclude that residues will not exceed 0.2 ppm, 5 or more days after treatment with up to 0.9 lb methomyl per acre.

Data onnpeppers are not adequate to conclude that residues on peppers will not exceed the tolerance, 10 or more days after appplication of 0.45 lb per acre. Additional data are needed.

There are no data on residues of methomyl in tomato pomace.

Vegetables, Leafy - I (Including beet tops, collards, dandelions, kale, mustard greens, parsley, swiss chard, turnip greens, and watercress). A tolerance of 6 ppm for residues of methomyl in or on each of the crops listed is supported by residue data for collards, kale, mustard greens, and turnip greens. Currently, methomyl is registered for use only on collards. Application of soluble concentrates to collards may not exceed 0.45 lb active methomyl per acre per application, and collards may not be harvested within 10 days of treatment.

RESIDUE SUMMARY

SAMPLE	PHI (days)	RATE(S) (lb/acre)	RESIDUE DISTRIBUTION ppm 1	1-6	>6	REF.
SOLUBLE CONCENTRATE - SOLID						
Collards	1-7	0.45-0.5	1	0	3	a
Collards	10-14	0.45-0.5	2	3	0	a
Collards	10-14	0.9-1.0	3	1	1	a
Kale	1-3	0.5	0	1	1	c
Kale	7-14	0.5-1.0	5	0	0	c
Mustard greens	1-3	0.5	0	0	2	d
Mustard greens	4-14	0.5-1.0	4	2	0	d
Turnip greens	1-14	0.5-1.0	7	4	0	e
SOLUBLE CONCENTRATE - LIQUID						
Collards	0-7	0.45	2	2	2	b
Collards	10-14	0.45-0.9	3	0	0	b
Kale	0-3	0.45	1	1	2	c
Kale	7-14	0.45-0.9	12	0	0	c

Mustard greens	0-3	0.45	1	1	2	d
Mustard greens	7-14	0.45-0.9	11	1	0	d
Turnip greens	0-3	0.45	1	1	2	e
Turnip greens	7-14	0.45-0.9	12	0	0	e

Residue data were obtained in VA, SC, AR, FL, and GA.
a. dupont 1976, 00008535
b. Hofmaster 1976, 00008359
c. Hofmaster 1976, 00003360
d. Hofmaster 1976, 00008361
e. Hofmaster 1976, 00008362

The data are sufficient to demonstrate that residues on collards, kale, mustard greens, and turnip greens are unlikely to exceed 6 ppm, 10 or more days after application of soluble concentrates at rates not exceeding 0.45 lb per acre.

Vegetables, Leafy - II (including broccoli raab, fennel, kohlrabi, rhubarb, salsify tops, and sugar beet tops). Based on residue data submitted in support of the registration of methomyl on cabbage, broccoli, Brussels sprouts, and cauliflower, a tolerance of 0.2 ppm was established for residues of methomyl on all members of the crop grouping, Leafy vegetables [40 CFR Section 180.34(f)]. Over the years, the use of methomyl on most crops within the CFR grouping has been amended, and tolerances on these crops have been adjusted accordingly. Of the crops listed above, sugarbeet tops is the only commodity on which methomyl is now registered for use (see data under Vegetables, root crop).

Vegetables, root crop (including beets, carrots, chicory, garlic, green onions, horseradish, Jerusalem artichokes, leeks, onions, parsnips, potatoes, radishes, rutabagas, salfsify, shallots, spring onions, sugar beets, sweet potatoes, turnips, and yams). Soluble concentrates and granular formulations are registered for use on carrots, onions, potatoes, and sugar beets as shown in the following table:

CROP	MAXIMUM RATE lb/acre/appl.	PREHARVEST INTERVAL (days)
Carrots	0.9	1
Onions	0.45	28 (green), 7 (dry bulb)
Potatoes	0.9	6
Sugar Beets	0.9	7 (roots), 30 (tops)

A tolerance of 0.2 ppm (negligible residue) has been established for residues of methomyl on root crop vegetables.

RESIDUE SUMMARY

SAMPLE	PHI (days)	RATE(S) (lb/acre)	RESIDUE DISTRIBUTION ppm			REF.
			<.05	.05-0.2	>.2	
SOLUBLE CONCENTRATE - SOLID						
Carrots/Ground application	0-5	0.9	10	1	0	a
Carrots/Ground application	1	1.8	2	0	0	a
Carrots/Aerial application	1	0.9-1.8	8	1	0	a
Dry bulb onions/Ground appl.	1-13	0.54-1.0	6	5	0	b
Green onions/Ground applic.	1-21	0.54	1	3	5	c
Green onions/Ground applic.	14-21	0.45	0	2	0	b

Green onions/Ground applic.	14	0.9-1.8	0	2	1	b
Green onions/Aerial applic.	10-13	0.25-0.5	0	1	2	b
Green onions/Aerial applic.	12	1.0	1	0	0	b
Potatoes/Ground application	1-12	0.9-3.6	9	0	0	d
Potatoes/Ground application	3-6	0.5-1.0	3	0	0	e
Potatoes/Aerial application	2-6	0.45-0.9	9	0	0	d
Sugar beet roots/Ground appl.	7-8	0.45-0.9	4	0	0	f
Sugar beet roots/Ground appl.	7-12	0.5-1.0	3	0	0	g
Sugar beet roots/Aerial appl.	1-8	0.45-0.9	6	0	0	f
Sugar beet tops/Ground appl.	7-15	0.5-1.0	2	1	11	g
SOLUBLE CONCENTRATE - LIQUID						
Carrots/Ground application	0-5	0.9	10	0	0	a
Carrots/Ground aplication	1	1.8	1	1	0	a
Carrots/Aerial application	1	0.9-1.8	3	2	0	a
Green onions/Ground applic.	7-21	0.45	0	2	4	c
Green onions/Ground applic.	7-21	0.45	10	4	1	b
Green onions/Aerial applic.	28	0.45	3	2	0	b
Potatoes/Ground application	1-12	0.9-3.6	5	0	0	d
Sugar beet roots/Ground appl.	7-18	0.9-1.8	4	0	0	h
Sugar beet roots/Aerial appl.	1-8	0.9	5	0	0	f
Sugar beet tops/Ground appl.	7-18	0.9	0	1	1	h
Sugar beet tops/Ground appl.	7-18	1.8	0	0	2	h

The bulk of the residue data (80%) were from CA and AZ.

a. duPont 1974, 00007837
b. duPont 1974, 00007192
c. duPont 1979, GS0028-008
d. duPont 1976, GS0028-023
e. duPont 1969, 00008295
f. duPont 1973, 00007161
g. duPont 1972, 00003044
h. Shell 1975, 00007004

Maximum application rates and preharvest intervals now in effect are supported by the residue data for carrots, potatoes, dry bulb onions, and sugar beet roots. The 30-day PHI for sugar beet tops is based on extrapolation of decline curves in reference g. The 28-day PHI for green onions is supported by limited residue data in reference b, and extrapolation of decline curves in reference c.

There are no valid data on residues of methomyl in processed sugarbeet fractions.

Watercress . (See Vegetables, Leafy - I).

Wheat . (See Grain Crops).

Tomatoes/Aerial application	0-2	0.9-1.0	1	3	0	b
Tomatoes/Aerial application	2	0.9	2	0	0	g
Peppers/Ground application	1-3	0.5	0	1	1	e

Peppers/Aerial application	10	0.45	1	0	0	h
Peppers/Aerial application	10	0.45	2	0	0	i

* lb per 200 gallons

Residue data were obtained primarily in FL, CA, TX, AND OH.

a. duPont 1969, 00007094
b. duPont 1972, 00007039
c. Krueger et al. 1973, 05009890
d. duPont 1971, 00003742
e. duPont 1974, 00007626
f. duPont 1969 00009000
g. Shell 1975, 00007007
h. Shell 1976, 00006996
i. Shell 1976, 00006995

Chapter X

Case Bibliography

Guide to Use of This Bibliography

1. CONTENT OF BIBLIOGRAPHY. This bibliography contains citations of all the studies reviewed by EPA in arriving at the positions and conclusions stated elsewhere in the Standard. The bibliography is divided into 3 sections: (1) citations that contributed information useful to the review of the chemical and considered to be part of the data base supporting registrations under the Standard, (2) citations examined and judged to be inappropriate for use in developing the Standard, and (3) standard reference material. Primary sources for studies in this bibliography have been the body of data submitted to EPA and its predecessor agencies in support of past regulatory decisions, and the published technical literature.

2. UNITS OF ENTRY. The unit of entry in this bibliography is called a "study". In the case of published materials, this corresponde closely to an article. In the case of unpublished materials submitted to the Agency, the Agency has sought to identify documents at a level parallel to the published article from within the typically larger volumes in which they were submitted. The resulting "studies" generally have a distinct title (or at least a single subject), can stand alone for purposes of review, and can be described with a conventional bibliographic citation. the Agency has attempted also to unite basic documents and commentaries upon them, treating them as a single study.

3. IDENTIFICATION OF ENTRIES. The entries in this bibliography are sorted by author, date of the document, and title. Each entry bears, to the left of the citation proper, an eight-digit numeric identifier. This number is unique to the citatiuons, and should be used at any time specific reference is required. This number is called the "Master Record Identifier", or "MRID". It is not related to the six-digit "Accession Number" which has been used to identify volumes of submitted data; see paragraph 4(d)(4) below for a further explanation. In a few cases, entries added to the bibliography late in the review may be preceded by a nine-charaacter temporary identifier. This is also to be used whenever specific reference is needed.

4. FORM OF THE ENTRY. In addition to the Master Record Identifier (MRID), each entry consists of a bibliographic citation containing standard elements followed, in the case of materials submitted to EPA, by a description of the earliest known submission. The bibliographic conventions used reflect the standards of the American National Standards Institute (ANSI), expanded to provide for certain special needs. Some explanatory notes of specific elements follow:

   a. Author. Whenever the Agency could confidently identify one, the Agency has chosen to show a personal author. When no individual was identified, the Agency has shown an identifiable laboratory or testing facility as author. As a last resort, the Agency has shown the first known submitter as author.

b. Document Date. When the data appears as four digits with no question marks, the Agency took it directly from the document. When a four-digit date is followed by a question mark, the bibliographer deduced the date from evidence in the document. When the date appears as (19??), the Agency was unable to determine or estimate the date of the document.

c. Title. This is the third element in the citation. In some cases it has been necessary for Agency bibliographers to create or enhance a document title. Any such editorial insertions are contained between square brackets.

d. Trailing Parentheses. For studies submitted to the Agency in the past, the trailing parentheses include (in addition to any self-explanatory text) the following elements describing the earliest known submission:

   (1) Submission Date. Immediately following the word 'received' appears the date of the earliest known submission.

   (2) Administrative Number. The next element, immediately following the word 'under', is the registration number, experimental permit number, petition number, or other administrative number associated with the earliest known submission.

   (3) Submitter. The third element is the submitter, following the phrase 'submitted by'. When authorship is defaulted to the submitter, this element is omitted.

   (4) Volume Identification. The final element in the trailing parenthesis identifies the EPA accession number of the volume in which the original submission of the study appears. The six-digit accession number follows the symbol 'CDL', standing for "Company Data Library". This accession number is in turn followed by an alphabetic suffix which shows the relative position of the study within the volume. For example, within accession number 123456, the first study would be 123456-A; the second, 123456-B; the 26th, 123456-Z; and the 27th, 123456-AA.

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